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U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

NORTH AMERICAN FAUNA

No. 13

[Actual date of publication, October 16, 1897.]

REVISION OF THE NORTH AMERICAN BATS OF THE FAMILY VESPERTILIONIDÆ

BY

GERRIT S. MILLER, Jr.

Prepared under the direction of

Dr. C. HART MERRIAM

CHIEF OF DIVISION OF BIOLOGICAL SURVEY

WASHINGTON
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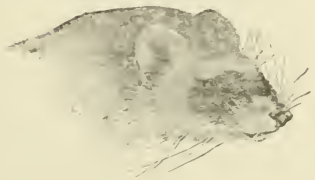

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Biological Survey,
Washington, D. C., July 1, 1897.

Sir: I have the honor to transmit herewith, and recommend for publication, the manuscript of No. 13 of North American Fauna, comprising a monographic revision of the bats of the family *Vespertilionidæ* inhabiting North America north of Panama, by Gerrit S. Miller, jr. It is based mainly on material belonging to the Biological Survey, where the work has been done.

The Department is constantly in receipt of bats sent for identification and of letters of inquiry concerning these animals; but heretofore, owing to the chaotic state of the literature relating to this group and the uncertainty respecting the status of the various species, it has been impossible to answer such inquiries with any degree of certainty. The present paper is intended to remove these difficulties.

Respectfully,

C. Hart Merriam,
Chief, Biological Survey.

Hon. James Wilson,
Secretary of Agriculture.

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REVISION OF THE NORTH AMERICAN BATS OF THE FAMILY VESPERTILIONIDÆ.

By Gerrit S. Miller, Jr.

Writers on American bats have published a large mass of facts concerning the distribution and comparative anatomy of members of the family *Vespertilionidæ*. Unfortunately, however, no work has yet appeared in which the numerous species by which this group is now known to be represented in North America[1] are treated from the standpoint of the systematic zoologist. In other words it has hitherto been impossible for anyone not thoroughly acquainted with the extensive and scattered literature of North American bats to identify specimens correctly. The present paper has been prepared with special reference to the long-felt want of a ready means to accomplish this object.

MATERIAL.

The greater part of the material on which this revision is based is contained in the collection of the Biological Survey of the U. S. Department of Agriculture. This collection of bats, which consists of more than 3,000 specimens, chiefly in alcohol, has been brought together during the past few years by the field naturalists of the Survey. In addition, the writer has examined the bats in the United States National Museum, the American Museum of Natural History, and several private collections, making a total of about 2,700 specimens of North American *Vespertilionidæ*. It is to be regretted that so few South American bats are contained in the museums of the United States that no definite conclusions can be reached concerning the relationships of several Mexican species to the forms occurring farther south. For this reason certain questions of nomenclature must for the present remain in a condition of uncertainty. It is also to be regretted that comparatively few well-prepared skins are available for comparison. Without good series of dry specimens it is impossible to determine the limits of individual variation in color, as conclusions of the most general kind only can be based on specimens that have been subjected to the action of alcohol. Series of bat skins as extensive as those by which most groups of small North American mammals are now represented will doubtless prove

[1] In the present paper the term North America is used to indicate the whole of the North American continent and the West Indies.

the existence of several well-marked geographic races in addition to those now recognizable.

In the lists of specimens examined it has not been thought necessary to distinguish between those contained in the National Museum proper and those in the collection of the Biological Survey. Specimens from other collections, however, are always specially designated.

CHANGES IN COLOR OF SPECIMENS PRESERVED IN ALCOHOL.

Bats which have been kept in alcohol for a period of more than a few months become so altered in color that they furnish reliable characters of size and form only. The rate and amount of change appear to vary with different species as well as with the strength of the preservative fluid and the amount of exposure to light. I have seen two lots of specimens of one species collected at the same place and on practically the same date and supposedly treated in the same way, yet after six years' immersion in alcohol those in one bottle still retained essentially their normal color, as proved by comparison with skins collected at the same time, while those in another bottle were so bleached as to show scarcely a semblance of their original appearance.

While the details of the changes produced by alcohol are not known, it may be said that a gradual bleaching and ultimate entire loss of color is the general rule, though as a preliminary step browns are often very noticeably reddened. The subject is one that merits experimental study.

SEXUAL VARIATION.

The range of sexual variation in North American *Vespertilionidæ* is always slight and in many cases scarcely appreciable. For the most part it consists in the slightly greater average size of the females. Even this is often trifling or absent, as in the case of *Myotis lucifugus longicrus* from Nicasio, Cal., six males of which average: Total length, 95.1; tail vertebræ, 45.8; forearm, 37.8; ear, 11.8; tragus, 7.3; while six females from the same locality average: Total length, 96.3; tail vertebræ, 44.1; forearm, 37.3; ear, 12.1; tragus, 7.2. In general, however, it is necessary to take this factor into consideration when comparing specimens from widely separated localities. I know of no instances of constant sexual differences in color among North American *Vespertilionidæ*, and only one of differences in cutaneous structures, that of *Rhogeëssa gracilis*, in which the only known male has in each ear a distinct glandular swelling, absent in the two females that I have examined (see Pl. I, fig. 7).

AGE VARIATION.

Young bats when nearly full grown often present characters different enough from those of the adults to cause confusion in identification. The fur of such immature specimens is usually shorter and more woolly

than that of the adults and the color darker and duller. The immature skull differs in size and form from that of the adult, but as the sutures disappear at an early age, it is often somewhat difficult to recognize.

I have found that the best guide to the age of those bats that I have studied is the condition of the finger joints. In specimens young enough to furnish unreliable characters these are always large and loosely formed, with epiphyses separate from the ends of the phalanges and metacarpals, both of which are distinctly enlarged for some distance from the joint (fig. 1 *a*). In adults the finger joints are small and compact, the epiphyses no longer visible, and the phalanges of essentially the same diameter throughout (fig. 1 *b*). These differences are equally apparent in alcoholic specimens and in dried skins.

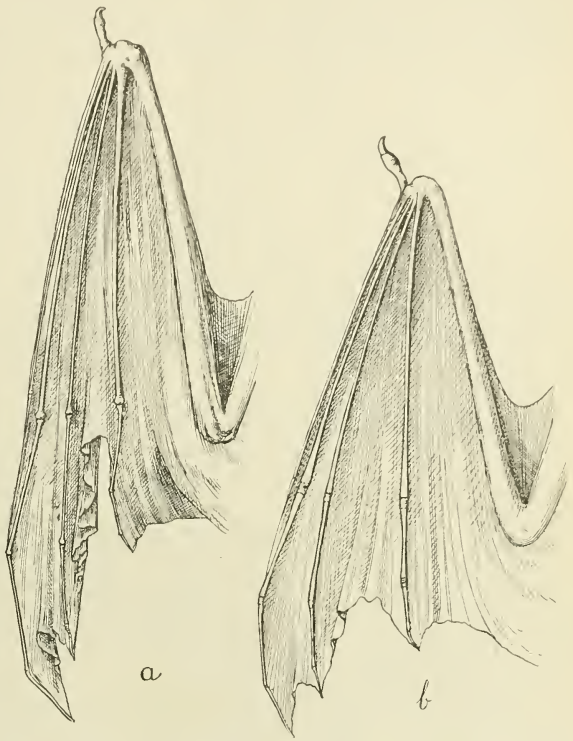

FIG. 1.—Wings of *Vespertilio serotinus*: *a*, adult; *b*, immature (natural size).

GEOGRAPHIC VARIATION.

As compared with other small mammals, bats show remarkably little geographic variation in size, proportions, or color. Thus breeding individuals of *Nycticeius humeralis* from Carlisle, Pa., Dismal Swamp, Virginia, and the extreme southern point of Texas are alike in color,[1] while in size they agree almost as closely as any three lots of specimens from one locality.[2] The only difference that can be found is a slight northward increase in size of the ears. Specimens of *Myotis lucifugus* from Washington, D. C., are not distinguishable from a series taken on Kadiak Island, Alaska, and skins of *Lasiurus cinereus* from Minnesota are exactly like others from southern California. While such constancy of characters in wide ranging species is unparalleled among American mammals, the only ones of which it is yet possible to

[1] So far as can be ascertained from comparison of specimens in alcohol.

[2] See table of measurements on page 120.

speak with certainty, the explanation of the fact is probably very simple. Living throughout the warmer part of the day in cool, dark, and for the most part damp situations, bats, even in widely separated localities, are exposed to comparatively little variation in temperature. Feeding at a distance above the surface of the ground and during the hours between sunset and sunrise, when colors are scarcely distinguishable, they are practically freed from that necessity for protective coloration which binds the color of most mammals so closely to that of their surroundings. From this reduction in the force of two of the most powerful factors in the production of geographic variation—differences in temperature and need for protective coloration—the comparative constancy in the characters of bats naturally results.

GEOGRAPHIC DISTRIBUTION.

From the peculiar habits of bats it results that the ranges of these animals are less closely limited by life areas than in the case of most mammals. To be more accurate, the frequent dampness and usual low, even temperature of the retreats occupied by bats during the hot part of the day expose the animals to essentially similar conditions wherever they may be, so that a given region of like environment is much more extended geographically for a bat than for most other mammals.[1]

Therefore, although many species seemingly disregard the laws of geographic distribution, their independence is more apparent than real.

MIGRATION.

A factor which introduces much uncertainty into the study of the distribution of bats is the little understood migrations which some species are known to make. That many bats migrate is a well-established fact, but the extent to which migration affects the apparent distribution of species is not known.

Although there are probably earlier references to the subject, the first mention of bat migration that I have seen is by Dobson, in his Catalogue of the Chiroptera in the British Museum, published in 1878. In his remarks on the geographic distribution of *Pipistrellus abramus*, Dobson says: "Found during the summer months in the Palæarctic region throughout middle Europe; * * * evidently migrates northward, * * * as it has never been taken in Europe in winter" (p. 227). In 1888 Dr. C. Hart Merriam published evidence in the Transactions of the Royal Society of Canada (V, Section V, p. 85), which showed conclusively that two American bats, *Lasionycteris noctivagans* and *Lasiurus cinereus*, perform regular periodical migrations. No details of the

[1] Analogous conditions are found in sphagnum bogs and heavy, damp woodlands, in which animals of northern affinities, such as shrews, lemmings, and red-backed mice, extend far south of the normal limit of their kind.

extent or exact dates of the northward and southward movements could then be given further than that the known southern records of the hoary bat (South Carolina, Georgia, Bermuda Islands) were all during autumn and winter, and that the silver-haired bat occurred in spring and fall about the light-house on Mount Desert Rock, 30 miles off the coast of Maine, a treeless islet where bats were at other times unknown. In August and September, 1890 and 1891, I had an opportunity to watch the appearance and disappearance of three species of bats, *Lasionycteris noctivagans*, *Lasiurus borealis*, *and Lasiurus cinereus*, at Highland Light, Cape Cod, Massachusetts. The animals, which were not to be found during the early summer, suddenly became numerous shortly after the middle of August and remained abundant for about a month, when they as suddenly disappeared. The regularity with which this phenomenon occurred on the two successive years over which my observations extended shows that the migration of bats is probably as definite as to dates and paths as that of birds.[1]

MEASUREMENTS.

For general purposes of identification, ten measurements are useful. These are: Total length, tail vertebræ, tibia, foot, forearm, thumb, longest finger, height of ear from meatus, width of ear, and height of tragus. The lengths of the separate phalanges of the fingers are important in special cases only.

The tables which accompany the descriptions of the different forms contain average measurements of specimens selected from as wide a range of localities as possible. Whenever the full complement of measurements is given, it is to be understood that all have been taken from alcoholic specimens by the writer. When the total length, length of tail, and the three measurements of the ear are omitted, the measurements have been taken from the dried skin. In a few cases the skin measurements are supplemented by the collector's measurement of total length and tail vertebræ. The use of specimens preserved in alcohol introduces a source of error in two measurements—total length and length of tail. According to the strength of the preservative fluid, both body and tail are to a varying degree shrunk or relaxed, so that considerable discrepancies in the averages of specimens taken at different localities by different collectors may result. In general, it is probable that these two measurements as given in the tables are a trifle shorter than they would have been if taken from fresh material.

It is unfortunate that detailed measurements of individuals can not be published, since averages are of use for comparison with averages only, and it often happens that a single specimen must be identified. Averages, moreover, give no indication of the normal range of individual variation at a particular locality.

[1] A detailed account of the migration of bats on Cape Cod was published in Science, N. S., V, No. 118, pp. 541–543, April 2, 1897.

ILLUSTRATIONS.

The illustrations in this paper are reproductions of pen-and-ink drawings made under my constant supervision by Mr. Frank Müller. Special difficulty has been encountered in obtaining satisfactory representations of the external ear and of the crowns of the teeth.

The ears of alcoholic specimens are generally sufficiently altered in form, by pressure and by the action of the preservative fluid, to retain only approximately the appearance which they had in the living animal. This is especially the case with such large-eared species as *Antrozous pallidus*, *Corynorhinus macrotis*, *Myotis evotis*, and others. In the impossibility of reproducing their original appearance, it has been thought best to represent the ears in a uniform but somewhat unnatural position, with the conch flattened and the external basal lobe turned outward. This will account for the apparently undue width of certain drawings.

The crown views of the teeth were first sketched with the aid of a camera lucida and afterwards corrected and finished by the use of hand lenses. The great difficulty in obtaining accurate and uniform results arose from the impossibility of keeping specimens in exactly comparable positions and from the considerable changes in outline resulting from every slight variation in the angle of vision. Therefore the drawings are not wholly satisfactory. They are published, however, in the belief that, such as they are, they may help to an understanding of the characters of the species.

NOMENCLATURE OF NORTH AMERICAN VESPERTILIONIDÆ.

To arrive at final conclusions in regard to the nomenclature of the *Vespertilionidæ* of North America, it will be necessary to consider in detail all names that have been based on those members of the group that inhabit the region in question, and also a few based on allied Old World species. The names may best be taken up alphabetically.

1. Generic and Subgeneric Names.

Adelonycteris H. Allen. **1892** (Proc. Acad. Nat. Sci., Phila., 1891, p. 466, Jan. 19, 1892), was proposed as a substitute for *Vesperus* Keys. & Blas., preoccupied in Entomology by *Vesperus* Latreille, 1829. The name is, however, a synonym of *Vespertilio* Linnæus, 1758, *Eptesicus* Rafinesque, 1820, and also of *Cnephæus* Kaup, 1829.

Aeorestes Fitzinger, **1870** (Sitzungsber. Math.-Nat. Cl. K. Akad. Wiss., Wien, LXII, Abth., I, pp. 427–436), is a synonym of *Myotis* Kaup, 1829. The group included three South American species, *Myotis villosissimus*, *M. nigricans*, and *M. albescens*.

Antrozous H. Allen, **1862** (Proc. Acad. Nat. Sci. Phila., p. 248), is the only generic name based on *Vespertilio pallidus* Le Conte.

Atalapha Rafinesque, **1814** (Précis des Découv. et Travaux Somiologiques, p. 12), is clearly based on a Sicilian bat.[1] The use of the name for a genus confined to America is therefore impossible.

Brachyotus Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 174–177), is a subgeneric name based on three European species of '*Vespertilio*' (*mystacinus*, *daubentonii*, and *dasycneme*) with ears shorter than head.

Cateorus Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 162–163), a subgeneric name based on '*Vesperus*' *serotinus*, is a synonym of *Vespertilio* Linnæus.

Cnephæus Kaup, **1829** (Skizzirte Entw.-Gesch. u. Natürl. Syst. d. Europ. Thierw., 1ster Theil, p. 103), is a generic name based on *Vespertilio serotinus* Schreber, a species congeneric with *Vespertilio fuscus* of America. The name is a synonym of *Vespertilio*.

Cnephaiophilus Fitzinger, **1870** (Sitzungsber. K. Akad. Wiss., Wien, LXII, Abth. I, p. 81), is a genus composed of very heterogeneous elements among which no type is mentioned. The species referred to it are *macellus* ('Borneo'), *pellucidus* ('S. E. Asia, Philippines'), *ferrugineus* ('Mittel Amerika, Surinam'), and the North American *noctivagans*. Whether or not the name may be available for some of the other species, it certainly is not for the one which comes within the limits of the present paper, since this was already provided with the generic name *Lasionycteris*.

Comastes Fitzinger, **1870** (Sitzungsber. Math.-Nat. Cl. K. Akad. Wiss., Wien, LXII, Abth. I, p. 565), is a synonym of *Myotis* Kaup, unless it may eventually be shown that the species on which it was based, *capaccinii*, *megapodius*, *dasycneme* and *limnophilus*, are subgenerically distinct from *Myotis myotis*.

Corynorhinus H. Allen, **1865** (Proc. Acad. Nat. Sci. Phila., p. 173), proposed as a generic name for *Plecotus macrotis* Le Conte and *P. townsendi* Cooper, is the only available name for the group of which *Corynorhinus macrotis* is the only known species.

Dasypterus Peters, **1871** (Monatsber. K. Akad. Wiss., Berlin, 1870, p. 912, published 1871), was established as a subgenus of *Atalapha* (=*Lasiurus*) to contain the species *intermedia*, *egregia*, *ega*, and *caudata*. It has recently been raised to full generic rank by Dr. Harrison Allen.

Eptesicus Rafinesque, **1820** (Annals of Nature, p. 2), originally con-

[1] II. G. ATALAPHA (Chauve-souris). Incisives nulles aux deux mâchoires, canines et machelières aigues: aucune crête sur le nez, queue presqu'entièrement unie aux membranes.

2. *Atalapha sicula*.—Oreilles de la longueur de la tête, et auriculées, une verrue sous la lèvre inférieure; corps roux brunâtre en dessus, roux cendré en dessous, ailes et museau noirâtre, queue saillante par une pointe obtuse.—Obs. J'ai observé cette espèce en Sicile, elle diffère de l'*Atalapha americana* (*Vespertilio noreboracensis* Lin.), autre espèce du même genre, par ses deux premiers et son dernier caractère.

tained two species, *E. melanops* and *E. mydas*.[1] *Eptesicus melanops* is without doubt the *Vespertilio fuscus* of Beauvois. *E. mydas*, however, can not be identified (see p. 32). The first species must therefore be taken as the type. Since this species is congeneric with *Vespertilio murinus* Linnæus (= *Vesperugo discolor* Natterer), the type of the genus *Vespertilio*, the name *Eptesicus* is a synonym of *Vespertilio*.

Euderma H. Allen, **1892** (Proc. Acad. Nat. Sci. Phila., 1891, p. 467, published Jan. 19, 1892), is the tenable name for the genus of which *Histiotus maculatus* J. A. Allen is the type and only known species.

Histiotus Gervais, **1855** (Exped. Comte de Castelnau Am. du Sud, Zool., Mammif., p. 77, Pl. XII), was based on the South American *Plecotus velatus* of Geoffroy. *Euderma maculatum* was originally described as a member of this genus, the name of which has not otherwise appeared in the literature of North American *Vespertilionidæ*.

Hypexodon Rafinesque, **1819** (Journal de Physique, de Chimie, d'Histoire naturelle et des Arts, LXXXVIII, p. 417), can not be identified with any known group of bats. The characters which Rafinesque assigns to the type species[2] may be those of a mutilated and distorted specimen of some of the small species of *Nycticeius*, *Pipistrellus*, or *Myotis*.

Hypsugo Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 167–169), is a synonym of *Pipistrellus* Kaup. It was based on '*Vesperugo*' *maurus* Blasius and '*V.*' *kraschenikowii* Eversmann.

Isotus Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 177–179), is a subgeneric name based on two European species of '*Vespertilio*' (*nattereri* and *ciliatus*) which have the ear about equal in length to the head. It is of course a synonym of *Myotis* Kaup, 1829, and of *Selysius* Bonaparte, 1841.

Lasionycteris Peters, **1865** (Monatsber. K. Preuss. Akad. Wiss., Berlin, 1865, p. 648), is the first name proposed for the genus of which *Vespertilio noctivagans* Le Conte is the only known species.

Lasiurus Gray, **1831** (Zoological Miscellany, No. 1, p. 38), is the first

[1] The original diagnosis of the genus *Eptesicus* is as follows:

"I. N. G. EPTESICUS. Four acute fore-teeth to the upper jaw, in two equal pairs, separated by a great interval and a large flat wart, each pair has two unequal teeth, the outside tooth is much larger and unequally bifid, the outside one much larger, inside tooth small and entire. Six fore-teeth to the lower jaw, equal very small, close and truncate. Canine teeth very sharp, curved and long. Grinders unequally trifid. Snout plain, nose without appendages. Ears separated, auriculated. Tail mucronate.—This genus appears to differ from all those of Geoffroy and Cuvier, among the extensive tribe of Bats. The name means house-flyer."

[2] 1. Nouveau genre. HYPEXODON. (Chauve-souris.) Museau nu; narines rondes, saillantes; incisives supérieures nulles, 6 inférieures émarginées, une verrue à la base extérieure des canines inférieures. Queue engagée dans la membrane. Le reste comme le genre *Vespertilio*.—I espèce *H. mystax*, entièrement fauve, dessus de la tête brun, ailes et membranes noires, queue mucronée, des moustaches, oreilles brunes auriculées, nervures intérieures et transversales; longueur totale, 3 pouces, dont la queue 2 pouces. En Kentucky.

name based on the bats of the American genus commonly but wrongly called *Atalapha*. It was introduced as follows: "The bats, the *Vespertiliones* of Geoffroy, might for convenience be divided into three genera, the true bats, *Vespertilio* * * *, the *Pachyotus* * * *, and the hairy tailed species of America (*Lasiurus*)." As the only hairy-tailed American bats known in 1838 were members of the modern genus *Lasiurus*, this brief statement may be taken as a definite indication of the author's meaning. In 1838 Gray referred the species *pruinosus* (= *cinereus*), *lasiurus* (= *borealis*), and *blossevillei* (= *borealis*, *fide* Dobson) to the group, which he then regarded as a subgenus or section of *Scotophilus* (Mag. Zool. & Bot., II, p. 498, Edinburgh, 1838).

Marsipolæmus Peters, **1872** (Monatsber. k. Preuss Akad. Wiss., Berlin, p. 260), was proposed in a subgeneric sense for a Mexican bat, *Vesperus albigularis* Peters, about the size of *Vespertilio fuscus*, with the dentition of that species, but with the outer border of the ear continuous with a fold of skin which extends back from the corner of the mouth, under and behind which a distinct pocket is formed. I have never seen this bat, and am unable to say what value is to be placed on the characters described. (See p. 104.)

Meteorus Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 167–169), is a synonym of *Vespertilio* Linnæus. It was proposed as a subgenus of '*Vesperus*' to include the species *nilssoni*, *discolor*, *savii*, *leucippe*, and *aristippe*.

Myotis Kaup, **1829** (Skizzirte Entw. Gesch. u. Natürl. Syst. der Europ. Thierw., 1ster Theil, p. 106), is the first name based on the large, long-eared, thirty-eight-toothed bat wrongly called *Vespertilio murinus* by Schreber.[1] It is therefore the tenable name for the genus of which this animal is the type. As the *Vespertilio murinus* of Schreber is not the *Vespertilio murinus* of Linnæus, another specific name must be applied to the former. The name *myotis* Bechstein[2] is available for this purpose. Hence the *Vespertilio murinus* of Schreber and of European writers in general must stand as *Myotis myotis* (Bechstein).

Nannugo Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 169–172), is a synonym of *Pipistrellus* Kaup, 1829. It was proposed as a subgenus of '*Vesperugo*' to include the European species *pipistrellus*, *kuhlii*, and *nattereri*.

Noctula Bonaparte, **1837** (Iconografia Fauna Italica, I, fasc. XXI, under *Vespertilio alcythoe*), based on *Vespertilio serotinus* Schreber is a synonym of *Vespertilio* Linnæus.

Nycticeius Rafinesque, **1819** (Journal de Physique, de Chimie, d'Histoire Naturelle et des Arts, LXXXVIII, p. 417), contained two species,

[1] Kaup says: "Fledermäuse von riesenmässiger Grösse, mit nacktem Gesicht, getrennten, kopfslangen Ohren, langen lanzettförmigen Ohrendeckeln, und 38 Zähnen."

[2] *Vespertilio myotis* Bechstein, Gemeinnütz. Naturgesch. Deutschlands, Bd. I, p. 1145, 1791 (*fide* Blasius).

N. humeralis Raf. and *N. tesselatus* Raf. Nothing in the description[1] indicates which of these the author considered as the type. *Nycticeius tesselatus* Raf. is *Lasiurus borealis* (Müller), and *N. humeralis* may with some degree of probability be identified with the small brown bat more generally known as *Nycticejus crepuscularis* Le Conte.[2] There is cer tainly nothing in the diagnosis of the genus or in the description of *Vespertilio humeralis* previously published in the American Monthly Magazine that precludes this possibility, while the size, the number of incisors, and the naked uropatagium point directly toward it. As *borealis* was removed to the genus *Lasiurus* by Gray in 1838, *humeralis* becomes the type of *Nycticeius*. The orthography of this name has had several emendations, as *Nycticeus*, *Nycticejus*, *Nycticea*, and *Nycticeyx*.

Nyctilestes Marsh, 1872 (Amer. Journ. Sci. & Arts, 3d ser., IV, p. 215), is a fossil genus based on part of a lower jaw and molars from Eocene or Lower Miocene strata near Henrys Fork, Wyoming. The remains present no characters to distinguish them generically from *Vespertilio*. Only one speciés, *Nyctilestes serotinus*, has been described.

Nyctitherium Marsh, 1872 (Amer. Journ. Sci. & Arts, 3d ser., IV, p. 127), is a genus based on the fragments of two lower jaws found with teeth in place, from Tertiary strata at Grizzly Buttes, Wyoming. The original description indicates no characters by which these teeth may be distinguished from those of small species of *Pipistrellus* or *Vespertilio*.

Nystactes Kaup, 1829 (Skizzirte Entw.-Gesch. u. Natürl. Syst. der Europ. Thierw., 1ster Theil, p. 108), based on *Vespertilio bechsteinii* Leisler is strictly synonymous with the same author's *Myotis*.[3]

Pachyotus Gray, 1831 (Zool. Misc., No. 1, p. 38), was first used as the name for a genus made by the combination of *Nycticeius* and *Scotophilus*. Later (Mag. Zool. & Bot., II, p. 498, 1838) Gray transferred it to *Vespertilio villosissimus* Geoffroy in a subgeneric sense. The name is of course untenable.[4]

Pipistrellus Kaup, 1829 (Skizzirte Entw.-Gesch. u. Natürl. Syst. der Europ. Thierw., 1ster Theil, p. 98). This name was based on *Vespertilio pipistrellus* Schreber, a species strictly congeneric with the '*Vesperugo*

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[1] 2. NYCTICEIUS. (Chauve-souris.) Diffère du genre précédent [*Hypexodon*] par 2 incisives supérieures séparées par un grand intervalle, accolées aux canines et à crénelures aiguës, 6 incisives inférieures tronquées, point de verrues aux canines.—Ce genre contient au moins 2 espèces, *N. humeralis* et *N. tesselatus*, que j'ai déjà décrits dans l'*American Monthly Magazine*, sous la dénomination générique *Vespertilio*, avec plusieurs autres nouvelles espèces de ces contrées.

[2] See Thomas, Ann. & Mag. Nat. Hist., 1891, 528.

[3] Kaup says: "Fledermäuse mit sehr langen getrennten Ohren, langem zugespitzem Ohrendeckel, 38 Zähnen und spitzmausähnlichem Rüssel."

[4] The original reference is as follows: "The bats, the *Vespertiliones* of Geoffroy, might for convenience be divided into three genera, the true bats, *Vespertilio*, with thin ears and membranes and a hairy face, the *Pachyotus*, with thick ears and membranes and bald swollen cheeks, including the genera *Nycticejus* and *Scotophilus*, and the hairy-tailed species of America (*Lasiurus*)."

georgianus' of the United States. It antedates the name *Vesperugo* by exactly ten years.

Plecotus Geoffroy, **1818**[1] (Description de l'Égypte, Mammifères, p. 112), included three species, 'l'Oreillard de Daubenton,' 'la barbastelle,' and a new species from Timor.[2]

As no American bats are congeneric with the species originally included in this genus, the name can not be used for any of the genera now under consideration. It has been applied to the species of *Corynorhinus*.

Rhogeëssa H. Allen, **1866** (Proc. Acad. Nat. Sci. Phila., p. 285), was proposed as a genus to contain the species *R. parvula* H. Allen and *R. tumida* H. Allen. The group, whose validity has not been questioned, has received varying treatment at the hands of different writers. Dobson placed it as a subgenus under '*Vesperugo*,' but Thomas has recently pointed out its close relationship to *Nycticeius*. The latter disposition appears to be the more natural.

The name has been amended to *Rhogöessa* by Marschall (Nomenclator Zoologicus, Mamm., p. 11, 1873).

Scotophilus Leach, **1821** (Trans. Linn. Soc. London, XIII, pt. 1, p. 69), type *S. kuhlii* Leach, is a genus peculiar to the Old World, where it apparently replaces the *Lasiurus* of America. It is mentioned here merely because the name has been used for the North American species of *Lasiurus*, *Vespertilio*, *Lasionycteris*, and *Pipistrellus* at times when these bats were supposed to be congeneric with Old World species.

Selysius Bonaparte, **1841** (Iconografia Fauna Italica, I, Introduzione [p. 3]), is a synonym of *Myotis* Kaup, 1829. It was based on the common European *Vespertilio mystacinus* of Leisler.

Synotus Keyserling and Blasius, **1839** (Wiegmann's Archiv f. Natur. geschichte, 5ter Jahrgang, Bd. I, pp. 305, 306), was based on the barbastelle, a European bat representing a genus not known to occur in America. The name, however, has been applied to the American genus afterwards called *Corynorhinus*. It is antedated by *Barbastella* Gray, 1821 (London Medical Repository, XV, p. 309. Type *Vespertilio barbastellus* Schreber).

Taphozous Geoffroy, **1818**[1] (Description de l'Égypte, Mammifères, p. 113), based on 'Le lerot-volant' and 'le *V. lepturus*,' which are without representatives in America. The red bat (*Lasiurus borealis*) was, however, included in this genus by Godman under the name *Taphozous rufus*.[3]

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[1] See Sherborn, Proc. Zool. Soc. London, 1897, p. 288.

[2] Dents incisives $\frac{4}{6}$; canines $\frac{2}{2}$; molaires $\frac{5\text{-}5}{6\text{-}6}$. Nez *simple et saillant;* chanfrein *large et métplat.* Oreilles *plus grandes* que la tête, et réunies; oreillon intérieur. Membrane interfémorale étendue et à angle saillant. Queue longue et toute entière enveloppée.

Obs. Les trois espèces de ce genre sont, l'oreillard de Daubenton, la barbastelle et une nouvelle espèce de Timor.

[3] Fauna Americana, p. 23, 1825.

Fitzinger[1] refers to a '*Taphozous brachmanus* Godman' among the synonyms of *Lasiurus* '*rufus*' (= *borealis*). This name, however, I have been unable to find in any of Godman's writings.

Vesperides Coues, **1875** (in Coues and Yarrow, Zool. of Wheeler's Exped., p. 83), was proposed as a subgenus of *Vespertilio* based on *Vespertilio noctivagans* Le Conte. The name is antedated by *Lasionycteris* Peters, 1865.

Vespertilio Linnæus, **1758** (Syst. Nat., 10th ed., I, p. 31), contained seven species: *rampyrus*, *spectrum*, *perspicillatus*, *spasma*, *leporinus*, *auritus*, and *murinus*. These have all been removed to other genera, as follows: *rampyrus* to *Pteropus* in 1762 (Brisson, Regn. Anim., ed. II, pp. 13, 153), *leporinus* to *Noctilio* in 1766 (Linnæus, Syst. Nat., 12th ed., p. 88), *spasma* to *Megaderma* in 1810 (Geoffroy, Ann. Mus. d'Hist. Nat., XV, p. 197), *auritus* to *Plecotus* in 1818 (Geoffroy, Descript. de l'Égypte, Mammifères, p. 112), *murinus*[2] to *Eptesicus* in 1820 (Rafinesque, Annals of Nature, 1820, p. 2), *perspicillatus* to *Artibeus* in 1821 (Leach, Trans. Linn. Soc. London, XIII, p. 75), and *spectrum* to *Vampyrus* in 1821 (Leach, Trans. Linn. Soc. London, XIII, p. 79).

The only European species are *auritus* and *murinus*, one of which must therefore become the type of the genus. The species *auritus* was removed to the genus *Plecotus* by Geoffroy in 1818, leaving *murinus* as type of the genus *Vespertilio*. The *Vespertilio murinus* of Linnæus is, however, a totally different animal from the bat afterwards described under the same name by Schreber. To understand the case fully it is necessary to go back to the first and second editions of Linnæus's Fauna Suecica. In the first he records only one bat, the 'Läderlapp,' 'Flädermus' or 'Nattblacka,' *Vespertilio caudatus*, *naso oreque simplici* (No. 18, p. 7, 1746). In the second edition he mentions two, *V. caudatus*, *naso oreque simplici*, *auriculis duplicatis*, *capite majoribus*, and *V. caudatus*, *naso oreque simplici*, *auriculis capite minoribus* (No. 2, pp. 1, 2, 1761). In the tenth edition of the Systema Naturæ these had been given binomial names, *Vespertilio auritus* and *V. murinus*, respectively. The account of the teeth of the latter in the second edition of Fauna Suecica is as follows:[3]

> Dentes primores superiores 6, acuti distantes.
> inferiores 4, acuti contigui.
> Laniarii superiores 2, anteriore majore.
> inferiores 3, antico maximo.
> Molares utrinque 3, tricuspidati.

[1] Sitzungsber. K. Akad. Wiss. Wien, LXII, 1ste Abth., p. 402, 1870.

[2] Although Rafinesque did not actually place the species *murinus* in the genus *Eptesicus* he based the latter on a strictly congeneric form.

[3] In the first edition the dental formula is the same, except that the lower incisors are said to be five in number, an error corrected in the second edition.

It therefore appears that the *Vespertilio murinus* of Linnæus is a bat with ears shorter than the head, and with the dental formula:

$$i, \frac{2-2}{3-3}[1]; \; c, \frac{1-1}{1-1}; \; pm, \frac{1-1}{2-2}; \; m, \frac{3-3}{3-3} = 32.$$

The only common Scandinavian bats which combine these characters are the two usually known as *Vesperugo nilssoni* and *Vesperugo discolor*. To these strictly congeneric European species and their exotic representatives the generic name *Vespertilio* must be applied, regardless of its long misuse for a different genus.

The current misidentification of Linnæus's *Vespertilio murinus* has been recognized by at least three writers on European bats, Nilsson, Blasius, and Lilljeborg. Nilsson[2] discusses the matter at considerable length and arrives at the conclusion that the name *murinus* must be substituted for *discolor*, while the bat commonly known as *murinus* must take the specific name *myotis* Bechstein. As this author unites the genera '*Vesperugo*' and '*Vespertilio*,' he has nothing to say in regard to the validity of the generic names used by Keyserling and Blasius.

Blasius[3] regarded Nilsson's identification of *Vespertilio murinus* as doubtful, though he admitted that the animal described by Linnæus under that name could not have been the one generally called *Vespertilio murinus* by European authors at large. He therefore reasoned that Linnæus's name might be disregarded as undeterminable and in no way invalidating Schreber's later application.

Lilljeborg alone questioned the tenability of the generic name *Vespertilio* for the thirty-eight-toothed bats of Europe.[4] He says:

* * * As regards modifying the Linnæan generic name *Vespertilio*, it may be urged that Linnæus did not include in it any of the species referred to it by Keyserling and Blasius. Further, it would have been more correct to apply the name *Vespertilio* to the preceding genus ['*Vesperugo*'], since one of the species included in the genus by Linnæus (*Vespertilio murinus*) agrees, in all important characters at least, with the genus mentioned, as shown above. As, however, the modification of the name introduced by Keyserling and Blasius has become time-sanctioned, it will be retained, although we consider the objections against it reasonable.[5]

Vesperugo Keyserling and Blasius, **1839** (Wiegmann's Archiv f. Naturgesch., 5ter Jahrgang, Bd. I, p. 312), was proposed as a genus to contain the following species up to that time commonly associated with *Vesper-*

[1] In Linnæus's statement the figures 4 and 6 are evidently transposed.

[2] Skandinavisk Fauna, I, Däggdjuren, 2d ed., 1847, pp. 17–20.

[3] Naturgesch. d. Säugethiere Deutschlands, pp. 74, 84, 1857.

[4] Sveriges och Norges Ryggradsdjur, I, Däggdjuren, p. 144, footnote, 1874.

[5] * * * I afseende på tillämpningen här af det Linneanska genus-namnet *Vespertilio*, kan deremot invändas, att Linné icke uti detta genus upptagit en enda af de arter, som Keyserling & Blasius derunder beskrifvit, och att det hade varit rättare, att använda detta namn för föregående slägte ['*Vesperugo*'], emedan en af de af Linné uti sl. *Vespertilio* upptagna arterna—*Vespertilio murinus* Lin.—åtminstone till hufvudsaklig del, enligt hvad ofvan blifvit anfördt tillhör nämde slägte. Da emellertid den af Keyserling & Blasius införda tillämpningen af namnet vunnit häfd, vilja vi bibehålla den, ehuru vi anse invändningen vara befogad.

tilio: serotinus, discolor, nilssoni, savii, leucippe, aristippe, noctula, leisleri, kuhlii, albolimbatus, nathusii, and *pipistrellus*. The first six were placed in the new subgenus *Vesperus*, the others in the subgenus *Vesperugo*. Hence the type must be a member of the second group. This group, however, contains two modern genera, the first represented by the species *noctula* and *leisleri*, the second by *kuhlii*, '*albolimbatus*' (= *kuhlii*, *fide* Dobson), '*nathusii*' (= *abramus*, *fide* Dobson), and *pipistrellus*. These had already been named *Pterygistes* and *Pipistrellus*, respectively, by Kaup in 1829. Hence *Vesperugo* is untenable in any connection.

Vesperus Keyserling and Blasius, 1839 (Wiegmann's Archiv f. Naturgesch., 5ter Jahrgang, Bd. I, p. 313), proposed as a subgenus of '*Vesperugo*' to include the species *serotinus*, *discolor*, *nilssoni*, *savii*, *leucippe*, and *aristippe*, is antedated by *Cnephæus* Kaup, 1829, *Eptesicus* Rafinesque, 1820, and *Vespertilio* Linnæus, 1758. It is moreover preoccupied in Entomology by *Vesperus* Latreille, 1829.

2. Specific and Subspecific Names.

Affinis (Vespertilio). H. Allen, Monogr. Bats N. Am., p. 53, 1864. The type of Dr. Harrison Allen's *Vespertilio affinis*, now in the United States National Museum, proves to be a typical example of *Myotis lucifugus*. It is therefore in no way related to the *Vespertilio nitidus* or *V. albescens* of Dr. Allen's second monograph.

Albescens (Vespertilio). E. Geoffroy, Ann. Mus. d'Hist. Nat., Paris, VIII, p. 204, 1806. This is a South American species of *Myotis*, probably closely related to *M. velifer* (J. A. Allen). The measurements given by Azara and quoted in the original description are: Total length, 80 mm.; tail, 33; extent of wings, 235; ear, 14. The name *albescens* has been used by Dr. Harrison Allen for *Myotis yumanensis*, *M. evotis*, *M. californicus* ('*Vespertilio albescens melanorhinus*'), *M. velifer*, *M. thysanodes* (under *M. velifer*), and *M. lucifugus* ('*Vespertilio albescens affinis*'), which he unites as subspecies.

Albigularis (Vesperus). Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 260, 1872. *Vespertilio albigularis* (Peters) is the type of the subgenus *Marsipolæmus*. The characters given in the original description indicate a well marked species, with which, however, I am wholly unacquainted. The type was collected in Mexico.

Alleni (Rhogeëssa). Thomas, Ann. & Mag. Nat. Hist., 6th ser., X, p. 477, 1892. This is the only name for this species.

Americana (Atalapha). Rafinesque, Précis des Decouv. Somiologiques, p. 12, 1814. This is a synonym of *Lasiurus borealis* (Müller), though properly speaking the name is a nomen nudum (see p. 106).

Arquatus (Vespertilio). Say, Long's Expedition to the Rocky Mountains, I, p. 167, footnote, 1823. The description clearly indicates *Vespertilio fuscus* Beauvois.

Auduboni (Vespertilio). Harlan, Featherstonehaugh's Monthly American Journal of Geology and Natural History, I, p. 220, Pl. II, November, 1831. Both description and plate indicate the silver-haired bat.

Austroriparius (Vespertilio lucifugus). Rhoads, Proc. Acad. Nat. Sci. Phila., p. 227, May, **1897.** *Vespertilio lucifugus austroriparius* Rhoads is a synonym of *Myotis lucifugus* (Le Conte). The type, a two-thirds grown young from Tarpon Springs, Florida, shows numerous characters by which it may be distinguished from northern adults, but the full grown topotypes are, as originally determined by Dr. Harrison Allen (see Rhoads, l. c.), indistinguishable from northern specimens of *lucifugus* that have been immersed in alcohol for a similar period. Even if it were assumed that the Tarpon Springs bat differed in some way not now discoverable from the '*lucifugus* of North Carolina and northward,' there could be little doubt that the southern form was the one originally described by Le Conte. (See page 63).

Bellii (Scotophilus). Gray, List Spec. Mamm. Brit. Mus., p. 30, **1843.** *Scotophilus bellii* Gray is a nomen nudum probably based on one of the West Indian forms of *Vespertilio fuscus*. Gray's account is as follows: "Bell's Bat. Scotophilus Bellii. *a* In spirits. West Indies.—Presented by Thomas Bell, Esq., F. R. S."

Borealis (Vespertilio). Müller, Natursyst. Suppl., p. 21, **1776.** Müller's *Vespertilio borealis* is the first name based on the red bat, *Lasiurus borealis*.

Brevirostris (Vespertilio). Maximilian, Wiegmann's Archiv. f. Naturgeschichte, 1861, Bd. I, p. 195. *Vespertilio brevirostris* of Maximilian is probably *Myotis lucifugus* (Le Conte). The original measurements are: Total length, 3″; extent, 9″ 4‴; ear from crown, $5\frac{1}{2}$‴; tragus, $1\frac{1}{3}$‴.

Calcaratus (Vespertilio). Rafinesque, American Monthly Magazine, III, p. 445, **1818.** No known bat agrees with the description of Rafinesque's *Vespertilio calcaratus*, which is as follows: "Tail one-third, body dark brown above, dark fallow beneath, wings black, shafts rose-coloured, a spur at the inner side of the elbow, hind feet black. Length 4 inches, breadth 12."

Californicus (Vespertilio). Aud. & Bachm., Journ. Acad. Nat. Sci. Phila., VIII, Pt. II, p. 285, **1842.** This is the earliest name based on the small western bat commonly known as *Vespertilio nitidus* H. Allen. The original description is as follows:[1]

V. californicus (Californian bat).—V. fusco lutescens, vellere longo et molli; trago longitudine dimidium auris excedente.

Californian bat.—With long silky hairs; tragus more than half the length of the ear; color light yellowish brown.

Description.—Anterior upper fore teeth bilobate. Head small; nose sharp; *ears of moderate size,* erect, rather narrow, and pointed. *Tragus linear, attennated.* Wings of moderate length, which together with the ears are naked. *Interfemoral membrane with a few scattered hairs; feet small;* nails slightly hooked. Tail projecting a little beyond the interfemoral membrane.

Color.—The pelage, *which is unusually long for the size of the body,* and very soft and glossy, is, on the upper surface, *dark plumbeous from the base, and broadly tipt with*

[1] I have italicized statements specially applicable to '*V. nitidus*.'

light yellowish brown: on the under surface the color is a little darker, owing to the outer extremities of the hairs being more narrowly edged with the prevailing color on the back, exhibiting the darker shades beneath. The ears and tragus are blackish—the nose, chin, wings, and interfemoral membrane dark brown.

Hab.—We have obtained but a single specimen, which was captured at California.

Dentition.—Incisors $\frac{2-2}{6}$. Canines $\frac{1-1}{1-1}$.

Dimensions.—Length of head and body, 1 inch 7 lines [40 mm.]; length of tail, 1 inch 5 lines [35.8]; length of spread, 7 inches 6 lines [190]; height of ear posteriorly, 3 lines [6.35]; height of tragus, 2 lines [3.8].

The only other small bats known to occur in California are *Pipistrellus hesperus*, *Myotis thysanodes*, *M. yumanensis*, *M. evotis*, and *M. lucifugus longicrus*. That *Vespertilio californicus* can not be *Pipistrellus hesperus* is shown by the description of the tragus. From *Myotis thysanodes* it is separated by its small size and unfringed interfemoral membrane; from *M. yumanensis* by its small feet; from *M. evotis* by its short ears, and from *M. lucifugus longicrus* by its light color and small size. *Myotis thysanodes* and *M. lucifugus longicrus* are moreover comparatively rare bats in California, while '*Vespertilio nitidus*' is one of the most common and universally distributed species.

Carolii (**Vespertilio**). Temminck, Monographies de Mammal., II, p. 237 (13me Monogr.), **1835-41.** The *Vespertilio carolii* of Temminck is without doubt *Myotis lucifugus* (Le Conte). That it is a *Myotis* is shown by the number of teeth, six molars in each jaw, while that it is not *M. subulatus*, the only other species known to occur in the vicinity of Philadelphia or New York, is shown by the short ear, 11.5 mm. in length.[1]

Carolinensis (**Vespertilio**). Geoffroy, Ann. du Mus. d'Hist. Nat., Paris, VIII, p. 193, **1806.**[2]

This species is *Vespertilio fuscus* Beauvois. Dr. Harrison Allen in

[1] The essential part of the original description is as follows:

"Taille et formes de notre pipistrelle, mais les oreilles plus longues. * * * oreilles médiocres, ovoïdes, un peu découpées à leur bord extérieur, sans lobe ou prolongement en avant; tragus en feuille de saule * * *. Dents incisives 4 par paire en haut et 6 en bas; molaires 6 partout; les deux premières fausses molaires de la mâchoire supérieure très petites, courtes et pointues.

"Pelage bicolore partout. Joues, côtes du cou et toutes les parties supérieures d'un brun-roussâtre à base des poils noirs; en dessous d'un blanc jaunâtre à la pointe et brun-foncé à la base * * *.

"Longueur totale 3 pouces 5 lignes, dont la queue prend 1 pouce 4 lignes; envergure 8 pouces 6 lignes; antibrachium 1 pouce 4 lignes; hauteur de l'oreille depuis le crâne jusqu'au bout 5 lignes; * * *.

"*Patrie.* L'Amérique septentrionale, dans les environs de Philadelphie et de New-York."

[2] The original description is as follows:

"2. *Vesp*[*ertilio*] *carolinensis.* Le vespertilion de la Caroline est moins grand que le précédent ['*V. murinus*'], mais d'ailleurs il lui ressemble beaucoup. Il a ses oreilles et oreillons de même forme et de même dimension relative; son poil est aussi de deux couleurs, cendré-noirâtre d'abord et brun-marron à la pointe. L'extrémité des poils est en dessous d'un jaune tirant sur le ventre; enfin les oreilles sont garnies de poils dans presque la moitié de leur longueur, et la queue a une petite portion qui n'est pas enveloppée par la membrane interfémorale. Ces considérations réunies à celles

his recent monograph has applied the name *carolinensis* to the Georgian bat (*Pipistrellus subflavus*), but there is no reason to doubt that Geoffroy's animal was the large brown bat. The head and skull are both figured, the former on Pl. I, the latter on Pl. II. These are only a trifle smaller than the head and skull of *Vespertilio serotinus* figured on the same plates, and very much larger than the figures of the head and skull of *Pipistrellus pipistrellus*, a species of about the same size as *P. subflavus*. The teeth are very indistinctly shown in the figure, but in the two copies which I have examined[1] I can find no indication of the second upper premolar of *Pipistrellus*.

Chrysonotus (Vespertilio). J. A. Allen, Bull. Am. Mus. Nat. Hist., N. Y., VIII, p. 240, November 21, **1896.** *Vespertilio chrysonotus* J. A. Allen, from Kinney Ranch, Wyoming, is a pale example of *Myotis evotis* (H. Allen), with mutilated tail. (See p. 80.)

Ciliolabrum (Vespertilio). Merriam, Proc. Biol. Soc. Washington, IV, p. 1, **1886.** *Vespertilio ciliolabrum*, Merriam, is the only name based on the pallid race of *Myotis californicus* inhabiting the plains of South Dakota, Kansas, and Texas. The type was taken at Banner, Kansas.

Cinereus (Vespertilio). Beauvois, Catalogue Raisonné du Museum de Mr. C. W. Peale. Philadelphie, p. 18, **1796.** *Vespertilio cinereus* Beauvois (originally misspelled *linereus*) is the first name based on the hoary bat, *Lasiurus cinereus*. The description is so detailed and accurate as to leave no doubt as to the animal that Beauvois had in mind.[2] The type came from Pennsylvania, somewhere near Philadelphia, where the species undoubtedly occurs during migrations.

Crassus (Vespertilio). F. Cuvier, Nouv. Ann. Mus. d' Hist. Nat., Paris, I, p. 18, **1832.** I can not identify F. Cuvier's *Vespertilio crassus*. The

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tirées de la teinte différente du pelage, m'ont paru établir avec assez de certitude la non-identité d'espèce de ce vespertilion avec le *murinus;* c'est ce qu'indiquent en outre les proportions du crâne. Le chanfrein est plus court et plus large dans le vespertilion de la Caroline. En voici les dimensions: longueur du corps, 61 millimètres; de la queue, 28; de l'envergure, 259.

"Cette espèce n'a point encore été décrite: elle m'a été remise par M. Bosc, qui se l'est procurée lors de son séjour à la Caroline. Ce savant naturaliste a bien voulu m'informer qu'elle y est excessivement commune. On la reconnoîtra aux caractères suivans: *Oreilles oblongues, de la longueur de la tête, relues en partie; oreillon en demi cœur. Pelage d'un brun marron en dessus, jaunâtre en dessous.*"

[1] In the Harvard College library, Cambridge, Mass., and in the Smithsonian library, Washington, D. C.

[2] 17. Chauve-souris grise. Deux premières dents supérieures fort petites & peu apparentes. Tête blanchâtre; oreilles rondes, plates, blanches, le pourtour noir, une appendice à la base. Poils du corps gris, vers la base; noirs vers la pointe & blancs à l'extrémité; de sorte que l'animal à l'air d'être moucheté de blanc. Ces poils s'étendent jusque sur la membrâne qui enveloppe la queue. La membrâne ailiforme est également velue en dessous à la partie antérieure, ainsi qu'au dessus à la base de l'ongle saillant. Cette membrâne est environ une fois plus grande que dans l'espèce précédente [*Vespertilio fuscus*]. Elle a de douze à quatorze pouces d'envergeure. Les narines sont émarginées.

Grey Bat. *Vespertilio linereus* [sic].

Elle ne se trouve point décrite dans les auteurs. Cette chauve-Souris se trouve dans la Pensilvanie.

animal may be *Nyeticeius humeralis*, but there is nothing in the original description[1] to indicate this with certainty. Fortunately the name is not needed as all the species now known to inhabit the eastern United States were already named at the time when it was published.

Creeks (Vespertilio). F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, I, p. 18, **1832.** *Vespertilio creeks* F. Cuvier is another unidentifiable species. Le Conte, however, who sent the type specimen to Cuvier, states that the animal is the same as *Nycticea crepuscularis* Le Conte (= *N. humeralis* Rafinesque). Nothing in the original description[2] contradicts this assertion.

Crepuscularis (Nycticea). Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 431, **1831.** This bat is the *Nyeticeius humeralis* of Rafinesque.

Cubanus (Vesperus). Gundlach, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 150, **1861.** The description of this species indicates a *Nyeticeius* closely related to *N. humeralis.* As I have seen no Cuban specimens, I am unable to say whether the animal is specifically distinct from the mainland form (see p. 121).

Cubensis (Scotophilus). Gray, Ann. Nat. Hist., IV, p. 7, **1839.** *Scotophilus cubensis* Gray is evidently the Cuban *Vespertilio.* The original description is as follows:

Fur blackish brown (in spirits); wings dark, blackish; underside of the interfemoral membrane whitish, with scattered hairs; feet large; heel bone short, tapering; ears moderate, entire; tragus ovate-lanceolate. Body and head 2¾; tail 1¾; fore arm 1¾. Hab. Cuba.

This is the first name based on the animal to which it refers.

Cyanopterus (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, **1818.** Rafinesque's *Vespertilio cyanopterus* can not be identified with any known bat. The original description is as follows:

Tail one-third, 2 incisores above, 6 beneath, body dark gray above, bluish gray beneath, wings of a dark bluish gray, shafts black, ears auriculated, longer than the head. Length 3 inches, breadth 10.

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[1] A la tête des Murinoïdes, deux fausses molaires anomales de chaque côté des deux mâchoires; l'oreille obtuse el l'oreillon en couteau.

Toutes les parties supérieures du corps sont d'un brun-marron grisâtre, et les parties inférieures blondes; les poils, à leur origine, sont plus foncés qu'à leur extrémité.

Des moustaches garnissent les côtés de la lèvre supérieure et l'extrémité de la mâchoire inférieure.

Longueur du corps, du bout du museau à l'origine de la queue, 2 pouces; de la queue, 1 pouce 8 lignes; envergure, 8 pouces 8 lignes.

Cette espèce est due à M. Lesueur, qui l'a envoyée de New-York, sous le nom que je lui ai conservé.

[2] Le V. Creeks, *V. Creeks.*

A la tête du Sérotinoïdes, point de fausses molaires anomales à la mâchoire supérieure, et une seule à l'inférieure; l'orielle est échancrée, et l'oreillon en couteau; les parties supérieures sont d'un brun jaunâtre, les parties inférieures d'un gris sale, les poils de toutes ces parties sont noirs à leur base. Des moustaches garnissent les côtés du museau et le dessous de l'extrémité de la mâchorie inférieure.

Longuer du corps, du bout du museau à l'origine de la queue, 2 pouces; de la queue, 1 pouce 6 lignes; envergure, 9 pouces.

De Géorgie. Dû aux recherches de M. le major Leconte.

Cynocephalus (**Nycticea**). Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 432, **1831**. This is a free-tailed bat, the common *Nyctinomus* of the southeastern United States.

Domesticus (**Vespertilio**). Green, Doughty's Cabinet of Natural History, II, p. 290, **1832**. The description refers without much doubt to *Myotis lucifugus* Le Conte, named only one year previously. Type locality a village in western Pennsylvania near a stream which enters the Ohio a few miles from Pittsburg.

Dutertreus (**Vespertilio**). Gervais, in Ramon de la Sagra's Hist. de l'Ile de Cuba, Mamm., p. 6; Atlas, Tome II, **1840**. This is *Vespertilio fuscus cubensis* (Gray), as shown by the number of teeth, 32, and by the size, forearm 47 mm.

Erythrodactylus (**Vespertilio**). Temminck, Monographies de Mamm., II, p. 238 (13me Monogr.), **1835–41**. Temminck describes his *Vespertilio erythrodactylus* as a bat with short, roundish ears, long tail, interfemoral membrane hairy on basal half above, four upper incisors, and general reddish-brown color.[1]

This is a combination of characters normally possessed by no known North American bat. The type is said to have come from the neighborhood of Philadelphia. It is probably *Pipistrellus subflavus* reddened by alcohol (see p. 8).

Evotis (**Vespertilio**). H. Allen, Monogr. North Am. Bats, p. 48, **1864**. This is the first name for the large-eared *Myotis* of the western United States.

Exilis (**Vespertilio**). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283, **1866**. *Vespertilio exilis* is a synonym of *Myotis californicus*. The type came from Cape St. Lucas.

Frantzii (**Atalapha**). Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin (1870), p. 908, **1871**. Peters's *Atalapha frantzii* from Costa Rica is the small, scantily furred southern race of *Lasiurus borealis*. It had previously been described as *Atalapha mexicana* by Saussure.

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[1]Taille moindre que la *pipistrelle*. Tout l'antibrachium, la base des doigts et la membrane interdigitale du premier doigt rougeâtre; les autres membranes noires. Oreilles poilues depuis la base jusqu'à plus de moitié de la longueur, petites ovoïdes; tragus en feuille de saule; queue très longue à grand bout libre; membrane interfémorale en dessus moitié poilue; par dessous, rayée de veines en losange, d'où naissent des soies très courtes disposées à claire-voie. Dents incisives 4 par paire en haut et 6 en bas; molaires 5 partout, seulement une fausse molaire à la mâchoire supérieure.

Pelage long, fin et soyeux; en dessus tricolore, au dessous bicolore. Toutes les parties supérieures d'une teinte brune-rougeâtre; mais un peu jaunâtre à la tête et au cou; les poils étant noirs à la base, puis jaunâtre et le bout brun-rougeâtre; moitié de l'interfémorale très poilue; en dessous brun foncé à la base et brun-roussâtre au bout; membranes des flancs et interfémorale couvertes de poils rares.

Longueur totale 2 pouces 10 lignes ou 3 pouces pour maximum, dont la queque prend 1 pouce 4 lignes; antibrachium 1 pouce 2 lignes: envergnre 7 pouces 6 lignes ou 8 pouces au maximum. * * *

Patrie. L'Amérique septentrionale dans les environs de Philadelphie.

Funebris (Lasiurus). Fitzinger, Sitzungsber. K. Akad. Wiss., Wien, 1ste Abth., LXII, p. 46, **1870.** *Lasiurus funebris* Fitzinger, based on the *Nycticejus noveboracensis* of Temminck,[1] from Tennessee and Missouri, is a synonym of *Lasiurus borealis* (Müller), as shown by the reference to the reddish-brown color and white shoulder spot.

Fuscata (Atalapha). Rafinesque, Annals of Nature, p. 2, **1820.** Rafinesque's *Atalapha fuscata* can not be identified. The original description is as follows:

> Ears longers than the head, auriculated and blackish; tail three-sevenths of total length, jutting only by an obtuse point; body brownish above, grayish beneath shoulders and cheeks dark brown; hind feet blackish, hairy above; wings blackish brown.—Found in the northern parts of the state of New York and in Vermont. Total length three and an half inches. My genus *Atalapha* (Prec. dec.) contain all the Bats without fore teeth; there are 3 or 4 species of them in the United States all blended under the name of *Vespertilio* (or *Noctilio*) *noveboracensis* by the writers.

Fuscus (Vespertilio). Beauvois, Catalogue Raisonné du Museum de Mr. C. W. Peale. Philadelphie, p. 18, **1796.** *Vespertilio fuscus* Beauvois is the first name based on the common brown bat of the eastern United States.[2] The original description is faulty, as it contains a glaring error with respect to the number of upper incisors, which are said to be only two. Nevertheless there can be no doubt as to the animal that Beauvois intended to describe, since only one brown bat of the size of *Myotis myotis* ('la chauve-souris ordinaire de France') inhabits the region about Philadelphia.

Georgianus (Vespertilio). F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, I, p. 16, **1832.** The specific name *georgianus* long passed current for the small *Pipistrellus* inhabiting the eastern United States. In 1893 H. Allen substituted for it the older name *carolinensis* Geoffroy. As already shown, however, there can be no doubt that Geoffroy's animal was *Vespertilio fuscus*. It is equally certain that Cuvier's name can not be applied to the Georgian bat, since his description probably refers to a *Myotis*, while in the same paper Cuvier accurately describes the Georgian bat as *Vespertilio subflavus*. Le Conte, who collected the specimens on which several of Cuvier's species were based, describes the Georgian bat under the name *georgianus*,[3] and expressly states that

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[1] Monographies de Mammalogie, II (13me Monogr.), p. 158.

[2] 16. Chauve-souris brune. Deux premières dents supérieures, distantes l'une de l'autre, & voisines des canines, une fois plus courtes que ces dernières: oreilles nues, noirâtres, ovales, avec un appendice à leur base; queue presqu'aussi longue que le corps (la tête excepté) membrâne ailiforme noirâtre: poils du corps bruns en dessus, grisâtres en dessous.

Brown bat. *Vespertilio fuscus.*

Cette Chauve-souris est la plus commune que l'on trouve dans les environs de Philadelphie. Elle ressemble beaucoup à la chauve-souris ordinaire de France, mais en diffère essentiellement par le nombre des dents de la machoire supérieure.

[3] Proc. Acad. Nat. Sci. Phila., VII (1854–55), p. 434, 1856.

this was the animal that the French author had in hand. The evidence is so strongly against this view that Le Conte's statement may be safely disregarded.[1]

Greenii (Scotophilus). Gray, List Spec. Mamm. Brit. Mus., p. 30, 1843. Gray's *Scotophilus greenii* is a *nomen nudum* which refers without much doubt, however, to *Vespertilio fuscus*. The name is introduced as follows: "GREEN'S BAT. SCOTOPHILUS Greenii. *a* In spirits.—North America. Presented by Jacob Green, M.D."

Gryphus (Vespertilio). F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., I, p. 15, 1832. Dr. Harrison Allen has recently used the name '*Vespertilio*' *gryphus* for the '*V.*' *lucifugus* and '*V.*' *subulatus* of his first monograph which he unites as subspecies.[2] The combination of characters; two premolars in each jaw, light yellow color, and hairy lips,[3] is not known in any bat inhabiting the eastern United States. Hence the description is wholly undeterminable. Le Conte refers the name to *Vespertilio fuscus*,[4] but this determination is very doubtful.

Henshawii (Vespertilio nitidus). H. Allen, Monogr. Bats N. Am., p. 103, 1893. *Vespertilio nitidus henshawii* H. Allen is a synonym of *Myotis californicus*, based on pale examples of the latter from near Wingate, N. Mex.

Hesperus (Scotophilus). H. Allen, Monogr. N. Am. Bats, p. 43, 1864. This is the first name based on the common *Pipistrellus* of the southwestern United States.

Humeralis (Vespertilio). Rafinesque, American Monthly Mag., III, p 445, 1818. While there is nothing absolutely diagnostic in the original

[1] The original description of *Vespertilio georgianus* is as follows:

"A la tête des Murinoïdes; l'oreille est échancrée et l'oreillon en alêne. Toutes les parties supérieures du corps sont colorées par un mélange de noir et de blond jaunâtre. Le noir paroît, parceque la pointe des poils qui est blonde ne recouvre pas, à cause de sa brévité, le reste de la longueur de ces poils qui est noir. Les parties inférieures sont grises, mais mélangées de noir, par la même cause qui fait paroître cette couleur aux parties supérieures. Des moustaches garnissent les côtés des lèvres supérieures, et le dessous de l'extrémité de la mâchoire inférieure.

"Longueur du corps, du bout du museau à l'origine de la queue, 1 pouce 6 lignes; de la queue, 1 pouce 2 lignes; envergure, 7 pouces.

"De Géorgie. Dû aux recherches de M. le major Leconte."

[2] Monogr. Bats N. Am., p. 75, 1893.

[3] The description is as follows:

"A la tête des Murinoïdes et deux fausses molaires anomales fort petites de chaque côté des deux mâchoires; l'oreille est échancrée et l'oreillon en conteau. Toutes les parties supérieures du corps sont d'un blond jaunâtre, les parties inférieures sont grises, mais les poils des uns et des autres sont noirs à leur extrémité inférieure. Les parties nues sont violâtres. Des moustaches garnissent les côtés de la lèvre supérieure et le dessous de l'extrémité de la mâchoire inférieure. Longueur du corps, de l'extrémité du museau à l'origine de la queue, 1 pouce 9 lignes; de la queue, 1 pouce 2 lignes; envergure, 7 pouces 10 lignes.

"Des environs de New York. Dû aux recherches de M. Milbert."

[4] Proc. Acad. Nat. Sci. Phila. VII (1854-55), p. 434, 1856.

description[1] of this species, its subsequent treatment is such as to leave no reasonable doubt that Rafinesque had in mind the bat afterward named *Nycticea crepuscularis* by Le Conte. In 1819 Rafinesque based the genus *Nycticeius* on two of his species of *Vespertilio* which differed from all others known to him in the possession of only two incisors in the upper jaw. One of these, *V. tesselatus*, was the red bat, *Lasiurus borealis*. The other, *V. humeralis*, must have been the twilight bat, as there is nothing in the description that precludes it, and no other small species with two upper incisors is known in the eastern United States.

Incautus (Vespertilio). J. A. Allen, Bull. Am. Mus. Nat. Hist., VIII, p. 239, November 21, **1896**. *Vespertilio incautus* J. A. Allen, is a synonym of *Myotis velifer* (J. A. Allen), based on specimens of the latter from San Antonio, Tex. (See p. 59.)

Intermedius (Lasiurus). H. Allen, Proc. Acad. Nat. Sci. Phila. (1862), p. 146. **1863**. This is the only specific name based on the bat now known as *Dasypterus intermedius*.

Keenii (Vespertilio subulatus). Merriam, American Naturalist, XXIX, p. 860, September 1, **1894**. *Vespertilio subulatus keenii* is the only name based on the dark form of *Myotis subulatus* occurring on the Queen Charlotte Islands, British Columbia.

Lanceolatus (Vespertilio). Maximilian, Reise in das Innere Nord-America, I, p. 364, footnote, **1839**. The specific name *lanceolatus* was proposed by Maximilian as a substitute for *subulatus*, should the animal which he designated by the latter name prove to be different from Say's.[2] Maximilian's *subulatus* is described at considerable length and is probably the *Vespertilio lucifugus* of Le Conte. The following measurements are given: Total length, 3″ 1‴; extent, 8″ 9‴; tail, 1″ 3‴; ear, 6‴; tragus, 2½‴.

Lasiurus (Vespertilio). Schreber, Säugthiere, Abth. I, Pl. LXII B, published with Abth. IV, Heft 34, **1781**.[3] The figure of *Vespertilio lasiurus* is a good representation of the red bat (*Lasiurus borealis* Müller, 1776). Dobson[4] cites this name as dating from 1775, in which case it would be the earliest for the species. This is, however, a mistake. Pl. LXII appeared with Abth. I in 1774, but Pl. LXII B, was not published until 1781 with Abth. IV, Heft 34. The species is mentioned in Abth. I (p. 176) as 'Die nordamerikanische Fledermaus.'

Lasurus (Vespertilio). Boddaert, Elenchus Animalium I, p. 71, **1785**.

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[1] Tail three-sevenths, upper incisores 2, remote, lower 6, body dark brown above, shoulders black, gray beneath, wings, tail, ears, and snout blackish, eyes under the hair, ears longer than the head, elliptical, auriculated. Length 3 1–2 inches, breadth 11.

[2] Diese Fledermaus beschrieb ich in meinem Tagebuche unter der Benennung *Vesp. lanceolatus*, sie hat aber viel Aehnlichkeit mit Say's *V. subulatus*. Zu Bethlehem in Pennsylvanien erhielt ich zwei Exemplare * * * .

[3] For date of publication see Sherborn, Proc. Zool. Soc. London, 1891, p. 589.

[4] Catal. Chiroptera Brit. Mus., p. 269, 1878.

Vespertilio lasurus Boddaert is probably a misprint for *V. lasiurus*, since reference is made to Schreber's plate.[1]

Lecontii (Plecotus). Cooper, Ann. Lyceum Nat. Hist. New York, IV, p. 72, 1848. Concerning *Plecotus lecontii*, Cooper says:

> The name *macrotis* I have ventured to supersede, as being in nowise distinctive of the species, but in reality derived from a generic character, which in some species is more developed than in the present. The ears being therefore rather *small* for the genus, this name becomes contradictory; and no American naturalist will regret the opportunity thus afforded of paying a well merited tribute to the discoverer of so many rare and remarkable animals of this country.

The name is of course a synonym of *macrotis* Le Conte.

Leibii (Vespertilio). Aud. & Bach., Journ. Acad. Nat. Sci. Phila., VIII, Pt. II, p. 284, 1842. *Vespertilio leibii* Aud. & Bach., from Erie County, Mich. [now Ohio] is probably *Myotis lucifugus* Le Conte. The measurements are as follows: "Length of head and body 1 inch 7 lines; tail 1 inch 4 lines; spread 7 inches; height of ear posteriorly 2½ lines; tragus 1 line."

Longicrus (Vespertilio). True, Science, VIII, No. 203, p. 588, Dec. 24, 1886. *Vespertilio longicrus* True, is the only name based on the common western subspecies of *Myotis subulatus*.

Lucifugus (Vespertilio). Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 431, 1831. The original description of *Vespertilio lucifugus* Le Conte is as follows:

> Anterior upper fore-teeth bilobate; body above dark brown, beneath cinereous; nose sub-bilobate; face with a nakedish prominence on each side; ears oblong, naked, tragus sub-linear, half as long as the ears; tail projecting a little beyond the membrane; length to the insertion of the tail two inches and a quarter; tail one inch and a quarter.

From this alone it would be impossible to identify the animal that the writer had in mind. Fortunately, Le Conte treated the species in more detail in a paper published in the Proceedings of the Academy of Natural Sciences of Philadelphia for 1855 (pp. 431–438). Here he recognizes three species of '*Vespertilio*' with thirty-eight teeth as occurring in the eastern United States. These are *V. subulatus*, *V. lucifugus*, and *V. georgianus*. *V. georgianus* is clearly *Pipistrellus subflavus*, which Le Conte placed with the thirty-eight-toothed species through an error in counting the teeth. *V. lucifugus* and *V. subulatus* of Le Conte are evidently based on individual variations in the shorter-eared of the two eastern species of *Myotis*. The only differences in Le Conte's descriptions of the two forms are the following: *V. subulatus:* Ear slightly emarginate; length 2.9; tail 1.1; extent 9.4; head .9; ears .4; orillon .3. *V. lucifugus:* Ears so much emarginated as to appear hooked; length 3.8; tail 1.6; extent 11.7; head .75; ears .45; orillon .2.

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[1] Boddaert's account is as follows:

"Lasurus. 16. V. cauda longissima, rostro obliquo truncato, *la longue Queue.* Schreb., tab. 52. B *longtailed Bat.*"

Habitat: "Quare Doct. Erxleben, Zimmermann, Pennant hunc notabilem vespertilionem omiserunt, mihi latet."

Macleayii (Scotophilus). Gray, List Spec. Mamm. Brit. Mus., p. 30, **1843.** *Scotophilus macleayii* Gray is a nomen nudum, probably based on *Vespertilio fuscus cubensis*. Gray says merely: "MACLEAY'S BAT. SCOTOPHILUS MacLeayii *a* In spirits. Male. Cuba.—Presented by W. S. MacLeay, Esq."

Macropus (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 288. **1866.** *Vespertilio macropus* H. Allen is a synonym of *Myotis yumanensis* (H. Allen). The name is, moreover, preoccupied by *Vespertilio macropus* Gould, 1854.[1]

Macrotis (Plecotus). Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 431, **1831.** *Plecotus macrotis* Le Conte is the first name certainly applied to the bat now known as *Corynorhinus macrotis*. Rafinesque's *Vespertilio megalotis* may have been the same animal, but his description is so poor that it is impossible to determine what he refers to.

Maculatus (Histiotus). J. A. Allen, Bull. Am. Mus. Nat. Hist., New York, III, p. 195, **1891.** *Histiotus maculatus* is the name under which the bat now known as *Euderma maculatum* was first described.

Megalotis (Vespertilio). Rafinesque, American Monthly Mag., III, p. 446, **1818.** There is nothing in the original description[2] of Rafinesque's *Vespertilio megalotis* by which the species can be identified. It is possibly the animal afterwards named *Plecotus macrotis* by Le Conte.

Melanops (Eptesicus). Rafinesque, Annals of Nature, p. 3, **1820.** When Rafinesque transferred his *Vespertilio phaiops* to the genus *Eptesicus*, he changed the specific name to *melanops*, thus adding another to the synonyms of *Vespertilio fuscus*.

Melanorhinus (Vespertilio). Merriam, North American Fauna, No. 3, p. 46, September 11, **1890.** *Vespertilio melanorhinus* Merriam is a synonym of *Myotis californicus*, based on a specimen of the latter from San Francisco Mountain, Arizona.

Melanotus (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, **1818.** Rafinesque's *Vespertilio melanotus* is hopelessly indeterminable. The original description is:

> Tail one-third, brown above, gray beneath, body blackish above, whitish beneath, wings dark gray, shafts black, ears auriculated, rounded. Length 4 1–2 inches, breadth 12 1–2.

Melas (Eptesicus). Le Conte, Proc. Acad. Nat. Sci. Phila., VII (1854–55), p. 438, **1856.** In a paper on the bats of the United States published in 1856, Le Conte refers to *Eptesicus melas* Rafinesque as an unidentified species. I have been able to find no such name in any of Rafinesque's writings and therefore suppose that *Eptesicus melas* is a misprint for *E. mydas*, especially as the latter is not mentioned by Le Conte.

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[1] Mammals of Australia, III (*fide* Dobson).

[2] Tail three-eighths of total length, body dark gray above, pale gray beneath, ears very large, duplicated, auricules nearly as long. Length 4 inches, breadth 12 inches.

Merriami (Vesperugo). Dobson, Ann. & Mag. Nat. Hist., XVIII, p. 124, 1886. *Vesperugo merriami* Dobson, was based on a specimen of *Pipistrellus hesperus* from Red Bluff, Tehama County, Cal., wrongly supposed to have been taken at Locust Grove, N. Y.

Mexicana (Atalapha). Saussure, Revue et Mag. de Zool., 2e sér., XIII, p. 97, 1861. *Atalapha mexicana* Saussure is the first name based on the southern race of *Lasiurus borealis*, afterwards described by Peters as *Atalapha frantzii*.

Mexicanus (Vespertilio). Saussure, Revue et Mag. de Zool., 2e sér., XII, p. 282, July, 1860. Under the name *Vespertilio mexicanus* Saussure described the large, dark Mexican form of *Myotis californicus*, which had hitherto received no name.

Miradorensis (Scotophilus). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 287, 1866. *Scotophilus miradorensis* H. Allen is the only name based on the large southern form of *Vespertilio fuscus*.

Monachus (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, 1818. The original description of Rafinesque's *Vespertilio monachus* leaves no doubt that it refers to *Lasiurus borealis* (Müller). It is as follows:

Tail one-fourth, hairy above, fringed laterally, body pale, fallow above and below, head and neck covered with a longer fur of a dark red fallow, wings dark gray, shafts red, hind feet black, nose red, ears concealed in the fur. Length 4 inches, breadth 12.

Monticola (Vespertilio). Aud. & Bach., Journ. Acad. Nat. Sci. Phila., I, No. 7, p. 92, October, 1841. *Vespertilio monticola* is probably *Pipistrellus subflavus* (F. Cuvier), though the description is not wholly pertinent to this species. The original account is as follows:

Vespertilio monticola (Mountain bat).—V. vespertilione subulata brevior; auriculus brevioribus; tragus nonexcedentibus, dimidiam longitudinem auriculæ; colore fulvo.

Mountain Bat.—Smaller than Say's bat (*V. subulatus*); ears shorter; tragus, less than half the length of the ear; color, yellowish brown. Upper fore teeth bilobate, ears moderate, naked, erect, rather broad at base; tragus linear, subulate, body small; wings long; tail projecting a line beyond the interfemoral membrane, which is slightly sprinkled with hair above and beneath.

Color.—The nose and chin are black; ears light brown; wing membranes dark brown. The whole of the fur of the body, above and beneath, is from the roots, of a uniform yellowish-brown color.

The species differs from Say's bat not only in color, but in the much shorter ears and tragus. The size and shape of the tragus we have found an invalnable guide in our American bats; the ears of the present species, when alive, are always erect; while those of Say's Bat are folded backward like those of the long-eared Bats—*Plecotus*. * * *

Dimensions.—Length of head and body, 1 inch 8 lines; length of tail, 1 inch 6 lines; length of spread, 8 inches; height of ear posteriorly, 3 lines; height of tragus, 1¼ lines.

N. B.—The tragus in Say's Bat is four-and-a-half lines in height. Several specimens of this Bat were obtained during the summer, on the mountains of Virginia, at the Grey Sulphur Springs. They were uniform in size and color.

Mydas (Eptesicus). Rafinesque, Annals of Nature, p. 3, **1820.** The description of *Eptesicus mydas* leaves the species hopelessly indeterminable. It is as follows:

> Fulvous above, grey beneath; wings, ears and tail, pale brown, shafts whitish; ears double the length of the head; tail naked, slightly mucronate, nearly as long as the body.—I have observed it in the barrens of Kentucky flying in the houses. Total length three inches, of which the tail includes five-twelfths. Ears three-quarters of an inch long. I mentioned it under the name of *Vesp. mydas* in my account of the Bats of the western states, (Am. Mag. v. 3). I have since instituted two other genera with them, *Hypexodon* and *Nycticeius* (Prodr. 70 N. G. An); the others are probably Atalaphes. I know already fifteen species of Bats in the United States, almost all new ones.

No bat is known to occur in Kentucky that combines the characters attributed to this animal.

Mystax (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, **1818.** This species which Rafinesque had already referred to as *Noctilio mystax*,[1] is described as follows:

> Tail two-fifths of total length, upper incisores none, lower 6, 2 warts at the lower jaw, body entirely fallow, top of the head brownish, ears brown, auriculated, longer than the head. Length 5 inches, breadth 14.

In the diagnosis of the genus *Hypexodon*, based on this species, some further characters—such as 'nostrils round, projecting,' and 'lips whiskered'—are added, which only serve to increase the impossibility of identifying the animal.

Nigricans (Vespertilio). Maximilian, Beiträge Naturgesch. Brasil., II, p. 266, **1826.** *Myotis nigricans* (Maximilian) is a species closely related to *M. californicus*, which it replaces in the tropical fauna from southern Mexico southward. The name was applied to *M. californicus* by Dr. Harrison Allen in his recent monograph (1893). In the original description Maximilian cites Schinz ('Thierreich u. s. w. B. I. p. 179') as authority for the name. As I have been unable to verify this reference I do not know whether the name was actually published before 1826.

Nitidus (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila. (1862), p. 247, **1863.** *Vespertilio nitidus* H. Allen, is the common small brown bat of the western United States and therefore the name is a synonym of *V. californicus* Aud. & Bach., 1842.

Noctivagans (Vespertilio.) Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 431, **1831.** This is the first name based on the silver-haired bat, *Lasionycteris noctivagans.*

Noveboracensis (Vespertilio). Erxleben, Syst. Regni Anim., I, p. 155, **1777.** Erxleben's *Vespertilio noveboracensis* was based on the New York bat of Pennant (Synop. Quadr., p. 367), 'Die nordamerikanische Fledermaus' of Schreber (Säugthiere, I, p. 176), and 'Der Neujorker' of Müller (Natursyst. Suppl., p. 20). It is therefore the red bat, *Lasiurus borealis.*

Noveboracus (Vespertilio). Boddaert, Elenchus Animalium, I, p. 71, **1785.** This is the red bat, *Lasiurus borealis* Müller. Boddaert men-

[1] American Monthly Mag., III, p. 354.

tions the white shoulder marks characteristic of the species and refers to Schreber and Pennant.

Obscurus (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 281, 1866. *Vespertilio obscurus* H. Allen, is one of the numerous synonyms of *Myotis californicus*. The type specimens came from Lower California.

Oregonensis (Vespertilio). H. Allen, Mongr. Bats N. Am., p. 61, 1864. The wording of Dr. Allen's account of *Vespertilio oregonensis* is so ambiguous as to leave some doubt as to whether he intended to apply the name to specimens from Fort Yuma and Cape St. Lucas (Nos. 5405, 5537, and 5402) or to a skin labeled *oregonensis* by Le Conte. In either case the name is a synonym of *V. californicus* Aud. & Bach. Under *V. nitidus* he says:

> Nos. 5405, 5537, and 5402, four specimens in all, present the following peculiarities: The fur is longer than in others of the collection. On the back the base of the hair is blackish; upper third pale yellow, turning to a delicate light-yellowish russet brown; on the belly the hair is dark brown at the base, with light tips; the hairs on the interfemoral membrane are also of a light color. In other respects the characters are the same as the other specimens. The dried specimen, No. 5512, labeled by Dr. Le Conte *V. oregonensis*, though never described by him, probably belongs to this variety. If the individuals having the above coloration should be found to constitute a new species, this name will be reserved for it.

Pallidus (Vespertilio). Le Conte, Proc. Acad. Nat. Sci. Phila., VII, (1854–55) p. 437, 1856. *Vespertilio pallidus* Le Conte is the only name based on the Eastern form of *Antrozous*, the type of the genus. Le Conte stated that his species came from California, but this is evidently an error, as pointed out by Baird and Harrison Allen. The type, now in the United States National Museum, is labeled 'Fort Clark, Texas.' It agrees in all respects with skins taken in the same region by Dr. E. A. Mearns.

Parvula (Rhogeëssa). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 285, 1866. *Rhogeëssa parvula* H. Allen, from the Tres Marias Islands, Mexico, is probably distinct from any of the members of the genus that occur on the mainland. The type is now mislaid or lost.

Pfeifferi (Atalapha). Gundlach, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 152, 1861. Gundlach's *Atalapha pfeifferi* is the only name based on the Cuban form of *Lasiurus borealis*.

Phaiops (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, 1818. Under the name *Vespertilio phaiops*, Rafinesque gave an accurate description of *Vespertilio fuscus* Beauvois. He says:

> Tail one-third of total length, naked, mucronate, body dusky bay above, pale beneath, face, ears and wings blackish, 4 incisores in the upper jaw, 2 on each side, divided by a large flat wart, unequal, the outside ones larger and bilobed, 6 small incisores at the lower jaw. Length 4 1–2 inches, breadth 13.

Priscus (Nyctitherium). Marsh, American Journ. Sci. & Arts, 3d ser., IV, p. 128, 1872. *Nyctitherium priscus* Marsh is a name based on a fragment of a fossil lower jaw from the Eocene or lower Miocene near Henrys Fork, Wyoming.

Propinquus (Vesperus). Peters, Monatsber. K. Preuss. Akad. Wiss.,

Berlin, p. 262, 1872. *Vesperus propinquus* Peters from Santa Ysabel, Guatemala, is the small southern form of *Vespertilio fuscus*. I can find no other name based on this animal.

Pruinosus (Vespertilio). Say, Long's Expedition to the Rocky Mountains, I., p. 167, footnote, **1823**. *Vespertilio pruinosus* Say, is the hoary bat, *Lasiurus cinereus* (Beauv.). It was described from a specimen taken at Engineer Cantonment, Washington County, Nebraska, 3 miles above the mouth of the Boyer River and not far from Council Bluffs, Iowa.

Pulverulentus (Vespertilio). Temminck, Monogr. de Mamm., II, p. 235, (13e Monogr.), **1835–1841**. Under the name *Vespertilio pulverulentus* Temminck gives an accurate description of a specimen of *Lasionycteris noctivagans* taken on the Missouri River.

Rafinesquii (Plecotus). Lesson, Manuel de Mammalogie, p. 96, **1827**. *Plecotus rafinesquii* Lesson is a name based on Rafinesque's indeterminable *Vespertilio megalotis*.[1]

Rubellus (Vespertilio). Beauvois, Catalogue Raisonné du Museum de Mr. C. W. Peale. Philadelphie, p. 18, **1796**. *Vespertilio rubellus* Beauvois is the red bat, *Lasiurus borealis* (Müller).[2]

Rubra (Vespertilio). Ord, in Guthrie's Geography, 2d American ed., II, p. 291, **1815** (Rhoads' Reprint, 1894). This is another synonym of *Lasiurus borealis* (Müller). The name appears in a nominal list of North American bats. In a footnote, however, Ord says: "Described by Mr. Wilson. See American Ornithology, Vol. VI, p. 60." Wilson's description, as well as his figure on plate 50 (fig. 4) of the 1812 edition, refers unquestionably to the red bat.

Rufus (Vespertilio). Warden, Description des Etats-Unis de l'Amérique Septentrionale, V, p. 606, **1820**. Warden's *Vespertilio rufus* is another synonym of *Lasiurus borealis* based on Wilson's description and figure.

Salarii (Vespertilio). F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, I, p. 15, **1832**. Like most of the species described in the same paper,

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[1] The original description is as follows:

"Pelage d'un gris foncé en dessus, et d'un gris pâle en dessous; oreilles très grandes et doubles, pourvues d'oreillons aussi longs qu'elles; n'est peut-être qu'une variété de notre oreillard. Habite les Etats-Unis."

[2] 18. Chauve-Souris rougeatre. Deux premières dents plus petites que les canines, mais apparentes, tête ainsi que le corps d'une couleur rougeâtre mêlée de quelques poils blanchâtres. Oreilles couleur de chair, nues, repliées et appendiculées à leur base. Narines émarginées et distantes l'une de l'autre. Vespertilio rubellus. Reddish bat.

Les poils du corps forment quelques fois des zones rougeatres et blanches. La membrâne ailiforme est velue en dessus à la partie antérieure, et couverte de poils roux dessus et autour de la queue. L'individu que nous décrivons est d'autant plus curieux qu'il a été pris avec trois petits qu'il porte sur son ventre. Ce qu'il y a de plus particulier, c'est que d'eux d'entr'eux ressemblent parfaitement à la mère pour la couleur et l'autre est tout à fait roux. La membrane ailiforme est couvertes de raie un peu transparentes qui vues au jour, représentent des quarrés en forme de Lozange. La couleur noire de cette membrane contraste avec les couleurs du corps et celle des divisions des pattes de devant, qui sont de couleur de chair, lorsque l'animal est en vie.

Vespertilio salarii is indeterminable. No known North American bat combines hairy lips, reddish brown color, and two premolars in each jaw.[1]

Seminola (Atalapha borealis). Rhoads, Proc. Acad. Nat. Sci. Phila., p. 32, 1895. This is the dull mahogany-brown race of *Lasiurus borealis* peculiar to the Austroriparian fauna. No other name has been based on this animal.

Septentrionalis (Vespertilio gryphus). Trouessart, Catalogus Mammalium tam Viventium quam Fossilium, p. 131, 1897. Trouessart's *Vespertilio gryphus* var. *septentrionalis* is the only name unquestionably based on the *Myotis* commonly known as *Vespertilio subulatus* Say. It is merely a latinization of 'northern form of *Vespertilio gryphus*,' the designation applied by Dr. Harrison Allen in his Monograph of 1893 to the *V. subulatus* of his first monograph.

Serotinus (Nyctilestes). Marsh, Am. Journ. Sci. & Arts, 3d ser., IV, p. 215, 1872.. The name *Nyctilestes serotinus* was applied by Marsh to the fossil jaw of a bat found by him at Grizzly Buttes, Wyoming.

Subflavus (Vespertilio). Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, I, p. 17, 1832. *Vespertilio subflavus* is one of the few North American bats named by F. Cuvier that can be identified. It is without doubt the Georgia bat (*Pipistrellus subflavus*), commonly known as '*Vesperugo georgianus*.' The peculiar coloring of this species, unique among the bats of the eastern United States, is very accurately described.[2] This is the first account of an American bat in which this color pattern is referred to. The mixture of dark and light hues in Cuvier's *V. georgianus* is due to the shortness of the fur in his specimen, which allows the dark bases of the hairs to appear irregularly on the surface. This is not at all the case with the small *Pipistrellus* of the eastern United States. In this bat the hairs are tricolored, dark at the bases, yellowish

[1] The original description is as follows:

"A la tête des Murinoïdes et deux fausses molaires de chaque côté des deux mâchoires; l'oreille est échancrée et l'oreillon en couteau. Toutes les parties supérieures du corps sont d'un brun-marron grisâtre, et les parties inférieures gris-blanchâtres. Aux parties brunes les poils sont plus foncés à leur moitié inférieure qu'à leur supérieure; ils sont noirs dans cette inférieure aux parties gris. Les parties nues sont brunes, des moustaches garnissent les côtés de la lèvre supérieure et le dessous de l'extrémité de la mâchoire inférieure.

"Longueur du corps, du bout du museau à l'origine de la queue, 1 pouce 6 lignes; de la queue, 1 pouce 7 lignes; envergure, 7 pouces 7 lignes.

"Des environs de New York. Dû aux recherches de M. Milbert."

[2] The original description is as follows:

"A la tête des Murinoïdes; l'oreille est échancrée, et l'oreillon en demi-cœur. Les parties supérieures du corps sont d'un blond gris clair, légèrement ondulées de brunâtre; les parties inférieures d'un blanc jaunâtre; les poils des parties supérieures sont noirs à leur base, blanchâtres dans la plus grande partie de leur longueur, et brunâtres à leur pointe; ceux des parties inférieures sont noirs à leur moitié inférieure, et d'un blanc jaunâtre à leur autre moitié. Des moustaches garnissent les côtés de la lèvre supérieure, et le dessous de l'extrémité de la mâchoire inférieure.

"Longueur du corps, du bout du museau à l'origine de la queue, 1 pouce 6 lignes; de la queue, 1 pouce 3 lignes; envergure, 7 pouces.

"De Géorgie. Dû aux recherches de M. le major Leconte."

in the middle, and dark at the extreme tips. This is exactly what Cuvier describes as the character of the fur of his 'Blondin' (*P. subflavus*).

Subulatus (Vespertilio). Say, in Long's Exped. to Rocky Mts., II, p. 65 footnote, **1823.** The original description of *Vespertilio subulatus* leaves the species undeterminable. It is as follows:

> Ears longer than broad, nearly as long as the head, hairy on the basal half, a little ventricose on the anterior edge, and extending near to the eye; tragus elongated, subulate; the hair above blackish at base, tip dull cinereous; the interfemoral membrane hairy at base, the hairs unicoloured, and a few also scattered over its surface, and along its edge, as well as that of the brachial membrane; hair beneath black, the tip yellowish-white; hind feet rather long, a few setæ extending over the nails; only a minute portion of the tail protrudes beyond the membrane. Total length, 2 7/10 inches. Tail, 1 1/2 inches.

While there is nothing in this account that refers unquestionably to the longer eared of the two species of *Myotis* inhabiting the eastern United States, the name has passed current for this animal so long that, after careful consideration of all the evidence, I am unwilling to substitute for it Trouessart's name *septentrionalis*, the only one unequivocally based on the species. Say's *Vespertilio subulatus* came from the Arkansas River, near the present town of La Junta, Colorado. The bats of this region are not well known, but at present *Myotis evotis*, *M. californicus ciliolabrum*, and *M. lucifugus longicrus* are the only members of the genus *Myotis* which may confidently be expected to occur there. From the known range of *Myotis subulatus* to the north and west, however, its regular occurrence in Colorado is by no means impossible. Apparently Le Conte was the first subsequent writer to define the name *subulatus*, and, as has already been shown, his animal was an individual variation of the shorter eared of the two eastern species. If this determination be taken as final, there can be no question as to the necessity of adopting the name *septentrionalis* for the longer eared animal, but at present the power of the 'first reviser' is so much in question that too much should not be staked on it. Harrison Allen, in 1864, applied the name *subulatus* to the longer eared of the two forms, and in this sense it passed unchallenged until 1893, when the same author united the *lucifugus* and *subulatus* of his earlier monograph under the specific name *gryphus*. This change has not been generally adopted, so that in retaining the specific name *subulatus* I am merely continuing the usage of the past thirty-four years, not, however, without grave misgivings that the reasons for so doing are in reality unsound.

Teliotis (Atalapha). H. Allen, Proc. Amer. Philos. Soc., XXIX, p. 1, February 11, **1891.** *Atalapha teliotis* H. Allen is the only name based on the Californian form of *Lasiurus borealis*.

Tenuidorsalis (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283, **1866.** This is a synonym of *Myotis californicus* based on a specimen (No. 5533, U. S. Nat. Mus.) from Cape St. Lucas, Lower California.

Tesselatus (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, **1818.** Rafinesque's *Vespertilio tesselatus* is *Lasiurus borealis* (Müller). The original description is as follows:

> Tail half of total length, hairy above, upper incisores 2, remote, lower 6, body fallow above, head pale, dirty fulvous beneath, with a faint fallow collar, with 2

hairy white spots above near the thumb, membrane blackish, netted of fulvous internally and clotted of same externally, shafts fulvous, nose bilobate, ears nearly concealed by the hair. Length 4 inches, breadth 12.

Townsendi (Plecotus). Cooper, Ann. Lyceum Nat. Hist. New York, IV, p. 73, **1837.** *Plecotus townsendi* Cooper is the only name based on the form of *Corynorhinus* inhabiting the northwestern United States.

Tumida (Rhogeëssa). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 286, **1866.** *Rhogeëssa tumida* H. Allen is the only name based on the small Mexican bat to which it is now applied.

Ursinus (Vespertilio). Temminck, Monographies de Mammalogie, II (13e Monogr.), p. 235, **1835-41.** The description of Temminck's *Vespertilio ursinus* refers without much question to *Vespertilio fuscus* Beauv., though the statement is made that there is no false molar in the upper jaw. Color, size, and external characters, however, agree with *V. fuscus.*

Velifer (Vespertilio). J. A. Allen, Bull. Am. Mus. Nat. Hist., New York, III, p. 177, **1890.** The name *Vespertilio velifer* has been applied by Dr. J. A. Allen to a large species of *Myotis* occurring in Mexico and the southwestern United States. The animal is closely related to the *Vespertilio albescens* of Dobson and may eventually prove to be the same as *V. albescens* Geoffroy.

Velox (Nyctitherium). Marsh, Am. Journ. Sci. & Arts, 3d ser., IV, p. 127, **1872.** *Nyctitherium velox* is a fossil bat from the Eocene or lower Miocene near Henry Fork, Wyoming.

Verærucis (Vesperugo). Ward, American Naturalist, XXV, p. 745, August, **1891.** *Vesperugo verærucis* Ward is the only name based on a form of *Pipistrellus* occurring in southern Mexico.

Virginianus (Vespertilio). Aud. & Bach., Journ. Acad. Nat. Sci. Phila., I, No. 7, p. 93, October, **1841.** *Vespertilio virginianus* can not be identified with any degree of certainty, though it is without much doubt one of the small species of *Myotis.* The original description is as follows:

Vespertilio virginianus (Virginian bat).—V. vespertilione monticolâ paululum longior, auriculus paululum longioribus magisque acutis; dentibus primoribus maxillæ superioris simplicibus; interfemorali membranâ nudâ; corpore supra fuligineo-fusco; subtus cinereo-fuscato.

Virginian bat.—A little larger than the Mountain Bat; ears a little longer and more pointed; upper fore teeth simple; interfemoral membrane naked; sooty brown above, ash brown beneath.

Dentition.—Incisors $\frac{2-2}{6}$. Canines $\frac{1-1}{1-1}$.

In size this species is intermediate between *V. carolinensis* and *V. subulatus.* The ear is naked, less rounded, and more pointed than either of the other closely allied species. The tragus is very narrow, linear, and less than half the length of the ear. The tail is inclosed in the interfemoral membrane, except the penultimate joint, which is free. The anterior upper fore teeth, instead of being sub simple, as in the *V. carolinensis,* or bilobate, as in *V. subulatus* and *V. montanus,* are simple.

Color.—The nose, upper lip and upper jaw are black; wings dark brown. The back is sooty brown; on each shoulder, at the insertion of the wing, there is a circular black spot about 4 lines in diameter; on the under surface cinerious brown.

Dimensions.—Length of head and body, 2 inches 5 lines; length of tail, 1 inch; length of spread, 8 inches 8 lines; height of ear posteriorly, 4 lines; height of tragus, 1¼ lines.

Hab.—Mountains of Virginia.

Volans (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 232, 1866. *Vespertilio volans* H. Allen is another of the numerous synonyms of *Myotis californicus*. The name was based on a specimen from Cape St. Lucas, Lower California.

Yumanensis (Vespertilio). H. Allen, Monogr. N. Am. Bats, p. 58, 1864. *Myotis yumanensis* of H. Allen is the small, large-footed bat, to which the same author a few years later applied the name *macropus*, and finally in his second Monograph regarded as identical with *Myotis albescens* (Geoffroy).

In a paper published in the Proceedings of the Philadelphia Academy of Natural Sciences for 1866, Dr. Allen gives a revised description of *M. yumanensis*, based on a Fort Yuma specimen not mentioned in the original account of the species. This specimen was *M. californicus*, as shown by the very small hind foot which measured only two lines, or 4.2 mm., about half as much as the foot of *M. yumanensis*.

LISTS OF NORTH AMERICAN VESPERTILIONIDÆ.

Forty-six species and subspecies of *Vespertilionidæ* are here recognized as occurring in America north of Panama and in the West Indies. This number will probably be materially increased when the West Indian and Central American species are better known, and when adequate series of skins from the mainland permit the definition of certain geographic races which doubtless exist but whose characters can not be determined from the material now in collections. The North American forms now known, with the names used for them by Harrison Allen in 1864, Dobson in 1878 and Harrison Allen in 1893, are as follows:

Comparative table of names used for North American Vespertilionidæ.

Names used in the present paper.	H. Allen, 1864.	Dobson, 1878.	H. Allen, 1893.
Antrozous pallidus (Le Conte)	Antrozous pallidus (part).	.....	Antrozous pallidus (part).
Antrozous pallidus pacificus Merriam.	Antrozous pallidus (part).	Antrozous pallidus ...	Antrozous pallidus (part).
Euderma maculatum (J. A. Allen).	.....	.....	Euderma maculata.
Corynorhinus macrotis (Le Conte).	Synotus macrotis.....	.....	Corynorhinus macrotis.
Corynorhinus macrotis pallescens subsp. nov.	Synotus townsendi...	.....	Corynorhinus townsendi.
Corynorhinus macrotis townsendi (Cooper).	....	Plecotus macrotis.....	
Myotis velifer (J. A. Allen)..	.....	.....	Vespertilio albescens velifer (part).
Myotis lucifugus (Le Conte).	Vespertilio lucifugus.	Vespertilio carolii	Vespertilio gryphus lucifugus. Vespertilio albescens affinis.

Comparative table of names used for North American Vespertilionidæ—Continued.

Names used in the present paper.	H. Allen, 1864.	Dobson, 1878.	H. Allen, 1893.
Myotis lucifugus longicrus (True).	.....	.....	Vespertilio nitidus longicrus.
Myotis lucifugus alascensis subsp. nov.	.....	.....	
Myotis yumanensis (H. Allen)	Vespertilio yumanensis.	.....	Vespertilio albescens. Vespertilio nitidus macropus. Vespertilio nitidus (pedomorphic variety).
Myotis yumanensis saturatus. subsp. nov.	.....	.....	
Myotis californicus (And. & Bach.).	Vespertilio nitidus....	Vespertilio nitidus ...	Vespertilio nitidus. Vespertilio nitidus henshawi. Vespertilio albescens melanorhinus. Vespertilio nigricans (part).
Myotis californicus ciliolabrum (Merriam).	.....	.....	Vespertilio nitidus ciliolabrum.
Myotis californicus caurinus subsp. nov.	.....	.....	
yotis californicus mexicanus (Saussure).	.....	.....	
Myotis nigricans (Maximilian).	.....	Vespertilio nigricans .	Vespertilio nigricans (part).
Myotis subulatus (Say).....	Vespertilio subulatus.	Vespertilio subulatus.	Vespertilio gryphus (northern form).
Myotis subulatus keenii (Merriam).	.....	.....	
Myotis evotis (H. Allen).....	Vespertilio evotis.....	Vespertilio evotis	Vespertilio albescens evotis.
Myotis thysanodes sp. nov...	.....	.....	Vespertilio albescens velifer (part).
Lasionycteris noctivagans (Le Conte).	Scotophilus noctivagans.	Vesperugo noctivagans.	Lasionycteris noctivagans.
Pipistrellus hesperus (H. Allen).	Scotophilus hesperus.	.....	Vesperugo hesperus.
Pipistrellus hesperus australis subsp. nov.	.....	.....	
Pipistrellus subflavus (F. Cuvier).	Scotophilus georgianus.	Vesperugo georgianus	Vesperugo carolinensis.
Pipistrellus subflavus obscurus subsp. nov.	.....	.....	
Pipistrellus veræcrucis (Ward).	.....	.....	
Vespertilio fuscus Beauvois.	Scotophilus fuscus....	Vesperugo serotinus var. Vesperus fuscus.	Adelonycteris fuscus.
Vespertilio fuscus miradorensis (H. Allen).	.....	.....	
Vespertilio fuscus propinquus (Peters).	.....	Vesperugo propinquus	
Vespertilio fuscus bahamensis subsp. nov.	.....	.....	
Vespertilio fuscus cubensis (Gray).	.....	.....	
Vespertilio albigularis (Peters).	.....	Vesperugo albigularis	
Lasiurus borealis (Müller)...	Lasiurus noveboracensis.	Atalapha noveboracensis.	Atalapha noveboracensis.
Lasiurus borealis seminolus (Rhoads).	.....	.....	
Lasiurus borealis pfeifferi (Gundlach).	.....	Atalapha noveboracensis var. pfeifferi.	
Lasiurus borealis teliotis (H. Allen).	.....	.....	Atalapha teliotis.

Comparative table of names used for North American Vespertilionidæ—Continued.

Names used in the present paper.	H. Allen, 1864.	Dobson, 1878.	H. Allen, 1893.
Lasiurus borealis mexicanus (Saussure).	.....	Atalapha novebora-censis var. frantzii.	
Lasiurus cinereus (Beauvois)	Lasiurus cinereus	Atalapha cinerea	Atalapha cinerea.
Dasypterus intermedius H. Allen.	Lasiurus intermedius.	Atalapha intermedia..	Dasypterus intermedius.
Nycticejus humeralis Rafinesque.	Nycticejus crepuscularis	Nycticejus crepuscularis.	Nycticejus humeralis.
Nycticeius humeralis cubanus (Gundlach).	.....	.....	
Rhogeëssa tumida H. Allen..	.....	Vesperugo parvulus..	
Rhogeëssa parvula H. Allen.	.....	.....	
Rhogeëssa gracilis sp. nov...	.....	.....	
Rhogeëssa alleni Thomas....	.....	.....	

List of North American Vespertilionidæ, with type localities.

Name of species	Type locality.
Antrozous pallidus (Le Conte)	El Paso, Texas.
Antrozous pallidus pacificus Merriam	Old Fort Tejon, Cañada de las Uvas, California.
Euderma maculatum (J. A. Allen)	Near Piru, Ventura County, California.
Corynorhinus macrotis (Le Conte)	Georgia (probably near Riceboro).
Corynorhinus macrotis pallescens subsp. nov.	Keam Cañon, Navajo County, Arizona.
Corynorhinus macrotis townsendi (Cooper)	Columbia River, Oregon.
Myotis velifer (J. A. Allen)	Santa Cruz del Valle, near Guadalajara, Jalisco, Mexico.
Myotis lucifugus (Le Conte)	Georgia (probably near Riceboro).
Myotis lucifugus alascensis subsp. nov.	Sitka, Alaska.
Myotis lucifugus longicrus (True)	Puget Sound.
Myotis yumanensis (H. Allen)	Old Fort Yuma, California.
Myotis yumanensis saturatus subsp. nov.	Hamilton, Washington.
Myotis californicus (Aud. & Bach.)	California.
Myotis californicus caurinus subsp. nov.	Massett, Queen Charlotte Islands, British Columbia.
Myotis californicus ciliolabrum (Merriam)	Trego County, Kansas.
Myotis californicus mexicanus (Saussure)	Mexico (probably Vera Cruz, Puebla, or Oaxaca).
Myotis nigricans (Maximilian)	Fazenda de Aga, near Iritiba River, Brazil.
Myotis subulatus (Say)	Arkansas River, near La Junta, Colorado.
Myotis subulatus keenii (Merriam)	Massett, Queen Charlotte Islands, British Columbia.
Myotis evotis (H. Allen)	Monterey, California.
Myotis thysanodes sp. nov.	Old Fort Tejon, California.
Lasionycteris noctivagans (Le Conte)	Eastern United States (exact locality unknown).
Pipistrellus hesperus (H. Allen)	Old Fort Yuma, California.
Pipistrellus hesperus australis subsp. nov.	Barranca Ibarra, Jalisco, Mexico.
Pipistrellus subflavus (F. Cuvier)	Georgia (probably near Riceboro).
Pipistrellus subflavus obscurus subsp. nov.	Lake George, New York.
Pipistrellus veracrucis (Ward)	Las Vegas, Jalapa, Vera Cruz, Mexico.
Vespertilio fuscus Beauvois	Philadelphia, Pennsylvania.
Vespertilio fuscus miradorensis (H. Allen)	Mirador, Vera Cruz, Mexico.
Vespertilio fuscus propinquus (Peters)	Santa Ysabel, Guatemala.

List of North American Vespertilionidæ, with type localities—Continued.

Name of species.	Type locality.
Vespertilio fuscus bahamensis subsp. nov	Nassau, New Providence, Bahamas.
Vespertilio fuscus cubensis (Gray)	Cuba.
Vespertilio albigularis (Peters)	Mexico.
Lasiurus borealis (Müller)	New York.
Lasiurus borealis seminolus (Rhoads)	Tarpon Springs, Florida.
Lasiurus borealis pfeifferi (Gundlach)	Cuba.
Lasiurus borealis teliotis (H. Allen)	California.
Lasiurus borealis mexicanus (Saussure)	Mexico (probably Vera Cruz, Puebla, or Oaxaca).
Lasiurus cinereus (Beauvois)	Philadelphia, Pennsylvania.
Dasypterus intermedius H. Allen	Matamoras, Tamaulipas, Mexico.
Nycticeius humeralis Rafinesque	Kentucky.
Nycticeius humeralis cubanus (Gundlach)	Cuba.
Rhogeëssa tumida H. Allen	Mirador, Vera Cruz, Mexico.
Rhogeëssa parvula H. Allen	Tres Marias Islands, Mexico.
Rhogeëssa gracilis sp. nov	Piaxtla, Puebla, Mexico.
Rhogeëssa alleni Thomas	Santa Rosalia, near Autlan, Jalisco, Mexico.

DESCRIPTIONS.

FAMILY VESPERTILIONIDÆ.

Characters.—Bats with turbinal bones folded, bony palate defective anteriorly owing to the absence of palatal processes to the premaxillæ (fig. 2*b*); molars with conspicuous W-shaped cusps; tail included nearly to tip in large interfemoral membrane; muzzle and nostrils variable, but former never provided with distinct noseleaf.

Remarks.—The family as thus defined is represented in North America by three well-marked subordinate groups, each of which may be ranked as a subfamily. Specimens from the region in question may be referred to their proper groups by the following wholly artificial key.

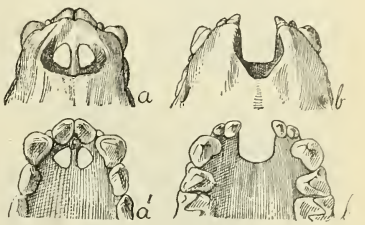

FIG. 2.—Anterior part of rostrum of species of (*a*) *Phyllostomatidæ* and (*b*) *Vespertilionidæ* (× 3).

KEY TO THE SUBFAMILIES OF NORTH AMERICAN VESPERTILIONIDÆ.

Lower incisors 4 ..... *Antrozoinæ* (p. 41)
Lower incisors 6.
  Ears joined at anterior base ..... *Plecotinæ* (p. 46)
  Ears separate ..... *Vespertilioninæ* (p. 54)

Subfamily ANTROZOINÆ.

This subfamily is represented by the genus *Antrozous* peculiar to southwestern North America. Its members may therefore be recognized by their generic characters.

Genus ANTROZOUS H. Allen.

1862. *Antrozous* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 247.
1864. *Antrozous* H. Allen, Monogr. N. Am. Bats, p. 67.
1878. *Antrozous* Dobson, Catal. Chiroptera Brit. Mus., p. 170.
1893. *Antrozous* H. Allen, Monogr. Bats N. Am., p. 64.

Type species.—*Antrozous pallidus* (Le Conte).

Geographic distribution.—Austral zones from Texas to the Pacific, and from the Columbia River to Queretaro on the tableland of Mexico.

Generic characters.—Dental formula: $i, \frac{1-1}{2-2}$; $c, \frac{1-1}{1-1}$; $pm, \frac{1-1}{2-2}$; $m, \frac{3-3}{3-3}$ = 28; mammæ 2; muzzle truncate; nostrils surrounded by a horseshoe-shaped ridge (fig. 3); lower lip free in front.

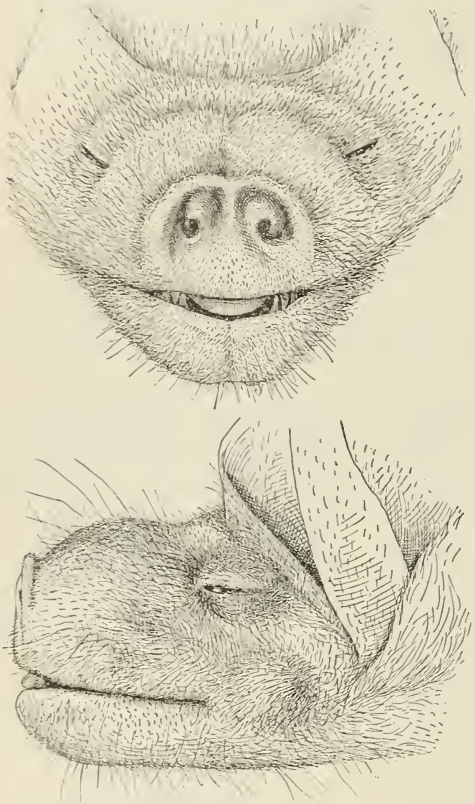

FIG. 3.—Muzzle of *Antrozous pallidus* (× 2).

Remarks.—The genus *Antrozous* differs so widely from all others occurring in America that it needs no comparison with any of these. In many ways, however, it resembles *Nyctophilus* of the Old World.[1] While adult *Antrozous* invariably has only two lower incisors in each mandible, an immature individual from Silver City, N. Mex., has a third on the right side (fig. 4). The outer lower incisor is probably normally present in the young, though very early crowded out by the growth of the others.

One species and one subspecies are known, both of which occur in the United States.

KEY TO THE SUBSPECIES OF ANTROZOUS.

Forearm 48 mm. to 53 mm.; color, whitish drab-gray ..... *pallidus* (p. 43)
Forearm 56 mm. to 60 mm.; color, pale yellowish, drab-brown ..... *pacificus* (p. 45)

[1] See H. Allen, Monogr. Bats N. Am. (1893), p. 65.

ANTROZOUS PALLIDUS (Le Conte). Pale Bat.

1856. *Vespertilio pallidus* Le Conte, Proc. Acad. Nat. Sci. Phila., VII (1854–1855) p. 137.
1862. *Antrozous pallidus* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 247.
1864. *Antrozous pallidus* H. Allen, Monogr. N. Am. Bats, p. 68 (part).
1878. *Antrozous pallidus* Dobson, Catal. Chiroptera Brit. Mus., p. 171 (part).
1893. *Antrozous pallidus* H. Allen, Monogr. Bats N. Am., p. 66 (part).

Type locality.—El Paso, Texas. (Type No. 5467, U. S. National Museum.)

Geographic distribution.—Lower Austral zone throughout the desert region of eastern California, Nevada, Arizona, New Mexico, and western Texas.

General characters.—Size large (average length of forearm about 50 mm.); ears large, reaching 20 mm. beyond tip of nose when laid forward; color very pale drab-gray.

Ears.—The ears (Pl. I, fig. 10) are larger than in any other North American *Vespertilionidæ* except the species of *Plecotinæ*. Laid forward they extend about 20 mm. beyond the tip of the nose. The anterior bases are rather close together, but separate. In form the ear is so simple as to call for no very detailed description. Anterior border strongly convex immediately above well-marked anterior lobe, then almost straight to narrowly rounded-off tip. Posterior border slightly concave immediately below tip, then gently convex to base. Posterior basal lobe very slightly developed. A transverse ridge 4 mm. in length extends obliquely upward and forward from near posterior base of tragus.

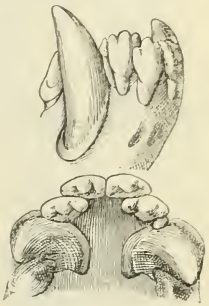

FIG. 4.—Abnormal front teeth of *Antrozous pallidus*, showing three incisors on right side. No. 60119 from Silver City, N. Mex. (× 10).

Tragus long, straight, and slender. Anterior border nearly straight to narrow tip. Posterior border at first almost parallel with anterior border, then slightly convex to notch above well-developed basal lobe. Whole posterior margin of tragus faintly crenulate.

Membranes.—The membranes are thick and leathery, much more so than in any of the North American *Vespertilioninæ* which approach this species in size. Wing membranes attached at base of toes; interfemoral membrane at base of terminal caudal vertebra. Free border of interfemoral membrane considerably longer than calcar.

Feet.—The feet are broad and strong, about half as long as tibia. Toes armed with large claws and sprinkled with a few short hairs on dorsum of phalanges.

Fur and color.—The fur is sparse and short, that on middle of back only about 8 mm. in length. It is closely confined to the body, and extends on ears and membranes in a narrow border along extreme base only.

On the back the fur is pale drab gray, most of the hairs with faintly dusky tips. Belly grayish white, tinged with drab on sides.

Skull.—The skull of typical *Antrozous pallidus* (fig. 5) varies in greatest length from 18 mm. to 20 mm., and in zygomatic breadth from 11 mm. to 12.5 mm. Brain case, rostrum, and palate broad. Length of bony palate behind molars (exclusive of median spine) usually less than width at base of median spine.

Teeth.—The teeth (fig. 6 *a*) are large and strong. Upper premolar transversely long and narrow. First lower premolar small and closely wedged between canine and second premolar.

Measurements.—See table, page 46.

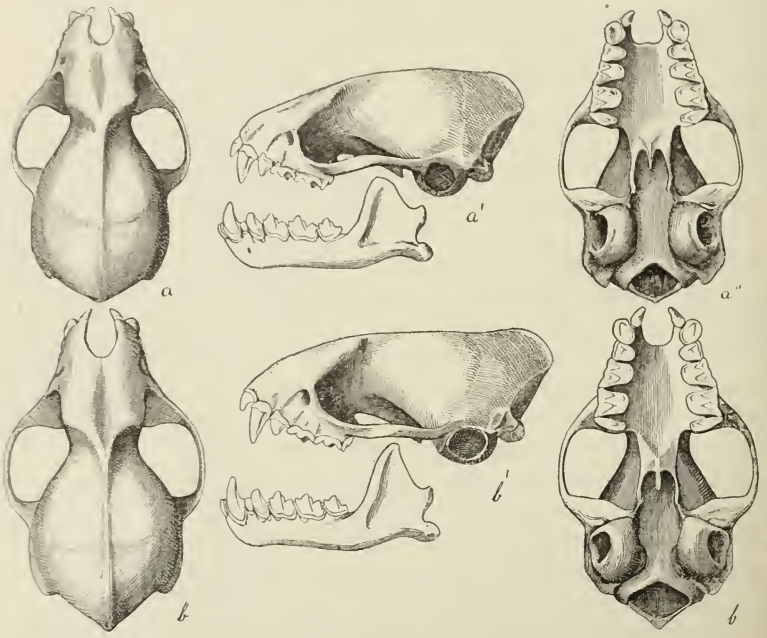

FIG. 5.—Skulls of (*a*) *Antrozous pallidus* and (*b*) *Antrozous pallidus pacificus* (× 2).

Specimens examined.—Total number, 64, from the following localities:

Arizona: Mouth of Colorado River, 1; Yuma, 5.
California: Old Fort Yuma, 1; Owens Valley, 2; Panamint Valley, 1; Walker Basin, 2.
Nevada: Amargosa Desert, 1; Timpahute Mountains, 2.
New Mexico: Silver City, 4 (skins).
Texas: Comstock, 6; Devils River, 8; El Paso, 1 (skin, type); Fort Hancock, 20 (3 skins); Painted Cave, 3; Paisano, 1; Sycamore Creek, 6.

General remarks.—In the original description of *Antrozous pallidus* the animal is said to be a native of California, but both Baird[1] and Harrison Allen[2] have shown that the type specimen came from El Paso,

[1] Rept. Mex. Bound. Surv., II, p. 5, 1859.
[2] Monogr. N. Am. Bats, p. 69, 1864.

Texas. The type, now in the United States National Museum, is in good preservation and clearly referable to the Eastern form.

Typical *Antrozous pallidus* is readily distinguishable from *A. p. pacificus* by its smaller size, paler color, shorter, broader skull, and narrower upper premolar.

ANTROZOUS PALLIDUS PACIFICUS Merriam.

1864. *Antrozous pallidus* H. Allen, Monogr. N. Am. Bats, p. 68 (part).
1878. *Antrozous pallidus* Dobson, Catal. Chiroptera Brit. Mus., p. 171 (part).
1893. *Antrozous pallidus* H. Allen, Monogr. Bats. N. Am., p. 66 (part).
1897. *Antrozous pallidus pacificus* Merriam, Proc. Biol. Soc. Washington, XI, p. 180, July 1, 1897.

Type locality.—Old Fort Tejon, Cañada de las Uvas, California.

Geographic distribution.—Austral zones in the United States west of the Rocky Mountains, south to Lower California and Queretaro.

General characters.—Slightly larger than typical *Antrozous pallidus* (total length about 120 mm., average length of forearm about 54 mm.); color, yellowish drab-brown.

Ears, membranes, and distribution of fur.—Essentially as in typical *pallidus*.

Color.—Color uniform yellowish drab throughout to base of hairs; under parts clear and unmixed with darker; back strongly but irregularly shaded by the dusky tips of the hairs.

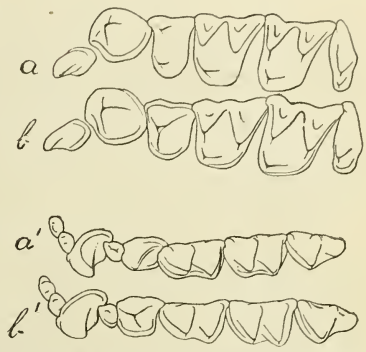

FIG. 6.—Teeth of (*a*) *Antrozous pallidus* and (*b*) *Antrozous pallidus pacificus* (×5).

Skull.—The skull of *Antrozous pallidus pacificus* (fig. 5 *b*) varies in greatest length from 20 mm. to 22 mm., and in zygomatic breadth from 13 mm. to 14 mm. Brain case, rostrum, and bony palate considerably narrower than in typical *pallidus*. Supraoccipital region more pointed and overhanging than in typical *pallidus*. Length of bony palate behind molars (exclusive of median spine) usually equal to or greater than width at base of median spine.

Teeth.—Teeth (fig. 6 *b*) essentially as in true *pallidus* except that all are larger and the upper premolar is conspicuously broader and shorter.

Measurements.—See table, page 46.

Specimens examined.—Total number, 59, from the following localities:

California: Alhambra, 1; Bear Valley, 8; Berkeley, 1; Dulzura, 6; Fort Crook, 1; Fresno, 3; Old Fort Tejon, 6; Poso Creek, 1 (skin); Santa Barbara, 3; Santa Ysabel, 4 (3 skins); Witch Creek, 2.

Lower California: Cape St. Lucas, 3; Comondu, 5 (skins); San Fernando, 5 (Miller coll.).

Oregon: Fort Dalles, 1 (skin); Twelve Mile Creek, 1.

Queretaro: Jalpan, 7.

Utah: St. Thomas, 1.

General remarks.—*Antrozous pallidus pacificus* needs no comparison with typical *pallidus* further than that already given under the latter.

Average measurements of subspecies of Antrozous pallidus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
pallidus	Texas: El Paso	1 [1]	.....	.....	20.5	10	49	9	92	.....	.....	.....
	Comstock	4 ♀ ♀	105	44.2	21	10	51	8.5	85	28	18.4	11.6
	Fort Hancock	4 ♀ ♀	115	46	20	10	49	8.3	86	30	20	14
	Sycamore Creek	6 ♀ ♀	109	44.6	20.6	10	51	8.9	88	28.5	18.6	13
pacificus	Queretaro: Jalpan	6 ♀ ♀	114	47.8	22.6	10.8	54.5	9.4	93	30	19	14
	California: Santa Ysabel	4 ♂ ♂	.....	.....	22	11	54.5	9.5	94	.....	.....	.....
	Dulzura	4 ♀ ♀	118	46.7	22.2	11	53.5	9.5	91	30	19	13
	Oregon: Fort Dalles	1	?	.....	.....	21	11	55	9	96	.....	.....	.....
	Twelve Mile Creek	1	?	.....	.....	20	12	56	10	93	.....	.....	.....

[1] Type.

Subfamily PLECOTINÆ.

This subfamily is represented in North America by two genera, *Corynorhinus* and *Euderma* which may be recognized among the other *Vespertilionidæ* of the region by their huge ears, joined together across the forehead. None of the North American *Vespertilioninæ* show this peculiarity.

Genus EUDERMA H. Allen.

1891. *Histiotus* J. A. Allen, Bull. Am. Mus. Nat. Hist., N. Y., III, p. 195 (not Gervais 1855).

1892. *Euderma* H. Allen, Proc. Acad. Nat. Sci. Phila., 1891, p. 467, Jan. 12, 1892.

1893. *Enderma* H. Allen, Monogr. Bats N. Am., p. 60.

Type species.—*Euderma maculatum* (J. A. Allen).

Geographic distribution.—The genus *Euderma* is at present known from one specimen taken in Ventura County, California.

Generic characters.—Dental formula: $i, \frac{2-2}{3-3}$; $c, \frac{1-1}{1-1}$; $pm, \frac{2-2}{2-2}$; $m, \frac{3-3}{3-3} = 34$.

Ears (Pl. I, fig. 11) even larger than in *Corynorhinus*, joined together across forehead and with posterior base of tragus united with external basal lobe. Face without evident glandular swellings.

Remarks.—The genus *Euderma* resembles *Corynorhinus* more closely than any other American bat, but differs in the presence of two less premolars, in the simple nostrils, and in the more complicated structure of the ear. Only one species is known.

EUDERMA MACULATUM (J. A. Allen).

1891. *Histiotus maculatus* J. A. Allen, Bull. Am. Mus. Nat. Hist., III, p. 195, February 20, 1891.

1893. *Euderma maculata* H. Allen, Monogr. Bats N. Am., p. 61.

Type locality.—Near Piru, Ventura County, California (probably at mouth of Castac Creek[1]). Type in American Museum of Natural History (No. $\frac{3229}{2551}$.) Skull now lost.

Geographic distribution.—*Euderma maculatum* is known from the type locality only.

General characters.—Size large; ears about three-fourths as long as forearm; color blackish blotched with white.

Ears.—Ears very large (Pl. I, fig. 11), fully three-fourths as long as forearm, joined together across forehead by a low band of membrane; anterior basal lobe continuous with keel which extends upward from anterior base of tragus and fades into substance of ear at about terminal part of lower fourth, beyond which it continues to tip as a well-defined line; anterior border of ear nearly straight through lower half, then gently convex to broadly rounded off tip; posterior border slightly concave immediately below tip, then convex to base; posterior basal lobe joined to base of tragus by a low band, below which a distinct pocket is formed; back of this band a conspicuous ridge extending inward toward meatus; ear membrane marked by about fifteen transverse ridges; anterior margin of ear sprinkled with whitish hairs.

Tragus nearly straight on anterior border, convex on posterior border except at posterior base, where it is straight for a distance of 2 mm. (the resulting form strongly suggests a table knife with short blade).

Membranes.—The membranes are broad and ample, the wing membrane (Pl. III, fig. 3) attached at base of toes, the interfemoral membrane at base of terminal caudal vertebra. Free border of interfemoral membrane apparently longer than calcar.

Feet.—The feet are moderately large, a little less than half as long as tibia. Toes sparsely sprinkled with short bristly hairs on dorsal surface and armed with strong claws. Calcar indistinct in the dried skin, but apparently short and without keel or terminal lobule.

Fur and color.—The fur is full and soft, about 12 mm. in length on middle of back. It extends on extreme base of ear, and on membranes forms a very narrow border close to body.

Back very dark sepia, almost black; occiput and fore part of neck distinctly less dark; hairs on sides and on middle of back faintly annulated with gray near tips; patch at base of tail and on each shoulder pure white; whole ventral surface of body white, the blackish bases of the hairs showing through irregularly; fur everywhere blackish at base; ears and membranes light brown.

Skull and teeth.—As the skull of *Euderma maculatum* is lost, I quote the descriptions published by Dr. J. A. Allen and Dr. Harrison Allen. The former writes:

Skull and dentition.—Basilar length, 16.5 mm. (0.65 in.); total length, 19 mm. (0.75 in.); zygomatic width, 10.9 mm. (0.43 in.); height, 7.6 mm. (0.30 in.); length of

[1] This information was given to members of a Biological Survey party by the collector of the type specimen.

lower jaw, 12.7 mm. (0.50 in.); height at condyle, 3.3 mm. (0.13 in.); height at coronoid process, 3.8 mm. (0.15 in.); length of upper tooth row, 6.86 mm. (0.27 in.); length of lower tooth row, 7.6 mm. (0.30 in.).

Dental formula: incisors, $\frac{2-2}{6}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{1-1}{2-2}$; molars, $\frac{3-3}{3-3}$ = $\frac{14}{18}$ = 32.

The skull is thin and papery, being evidently that of a young animal. The facial portion is narrow and pointed; the brain case is quadrate, flattened above, but rises abruptly at the frontal border, the forehead being suddenly depressed.

The lower border of the zygomatic arch is curved upward; the upper border is greatly expanded vertically, the upper border of the malar forming a high angular process at the middle of arch; the zygomatic process of the squamosal is short, and, with the malar, passes forward in a line nearly parallel with the axis of the skull, with only a very slight outward curvature. The tympanic bullæ are enormously expanded, having an antero-posterior length of 5.84 mm. (0.23 in.), and a transverse breadth of 3.3 mm. (0.13 in.), their length fully equaling one-third of the length of the skull. In other respects the ventral aspect of the skull presents nothing peculiar. The lower jaw is narrow, the coronoid process small, rising but little above the condyle; the angle is well developed.

The dentition is weak, the incisors and canines being very small, relatively to the molar series. The outer upper incisor is about one-half the size of the inner; both have a small outer cusp at the base. The upper canine is about equal in size to the anterior half of the upper premolar. The molars present nothing distinctive. The lower incisors are slightly double-notched (trifid); the lower canines are very small; the first premolar is about half the size of the second.

In his original account of the genus *Euderma*, Dr. Harrison Allen describes the skull and teeth as follows:

Skull.—Brain-case low, quadrate, the height one-half the bimastoid diameter. The metencephalon as long as mesencephalon and pro-encephalon. Sagittal crest rudimentary, does not extend beyond a line answering to the middle of the zygoma—the remaining portions of the posterior temporal crest widely separated—the anterior not defined. Dorsum of face-vertex with a shallow concavity which is not sharply defined; orbit with inflated inner wall and rugose elevated upper border; lachrymal tubercle marked. Infra-orbital canal short; the foramen on line with interval between second premolar and first molar. Line of the upper margin of the anterior nasal aperture if produced would intersect the second premolar; tympanic bone apparently incomplete above.

The paroccipital process bold, trenchant; sterno-mastoid impression deeply concave; mastoid composed entirely of the squamosal element. Zygoma quite as in *Corynorhinus*—the squamosal part twice as wide as maxillary; spheno-palatine foramen present, of large size. Occipital crest trenchant. Tympanic bone greatly inflated, equals one-third the length of the skull, not touching basi-occipital, or basi-sphenoid; excavate anteriorly. It extends to a line which answers to the middle of the glenoid cavity. The mesopterygoid fossa as long as one-third the distance from the posterior palatal border to the incisors. The sphenoidal foramen is at the bottom of a deep recess. The coronoid process is round, small, raised scarcely one-third the height of the ascending ramus; lower border of the horizontal ramus near the angle slightly concave. The angle is raised from the plane on which the mandible rests * * *

Upper teeth.—Incisors contiguous, slightly inclined toward the median line, but the lateral tooth separated from the canine by a moderate interval. Central incisor cuspidate, with a small cuspule projected midway on the posterior surface; a distinct cuspule also arises from the cingulum posteriorly. Lateral incisor one-half the size of the central, and cuspidate, with a small cuspule arising from the cingulum on the anterior and a second on the posterior portion. Canine not larger than the

second premolar, the buccal surface is abruptly convex. The first premolar is small, not wedged in, with complete cingulum. The space between it and canine narrower than that between it and second premolar. The second premolar as long as the canine and slightly fluted. Molars as in *Corynorhinus*.

Lower teeth.— Incisors crowded, trifid, i. e., the main cusp possesses a well-developed cuspule on each side of the base, the cingulum on the posterior side being large. The first and second teeth overlap for a distance equaling one-half of their diameters. The third incisor retains a posterior cuspule which is larger than the anterior and separated from the main cusp by a wide interval. The canine is small and projects but a slight degree above the incisors. It exhibits a marked cuspule on the cingulum anteriorly.

Measurements (from skin).—Total length, 110; tail vertebræ, 50; tibia, 21; foot, 9; forearm, 50; thumb, 6.8; longest finger, 91; ear from meatus, 34; width of ear, 22; tragus, 13; greatest width of tragus, 5.

Specimens examined.—One, the type (Am. Mus. Nat. Hist., New York).

General remarks.—*Euderma maculatum* differs so widely from all other known bats that no comparison with any is necessary. Its peculiar color at first suggests albinism, but since the fur is everywhere dark at base, even in the white areas, the pattern is probably normal. It is useless to hazard any conjecture as to its probable geographic range or exact faunal position.

The following note on this bat is kindly furnished by Dr. C. Hart Merriam:

> The type of this remarkable genus and species, recently described by Dr. J. A. Allen, is believed to have been obtained at the mouth of Castac Creek in the Santa Clara Valley, near San Fernando, Cal. The type specimen remains the only one thus far collected, but the species probably ranges over much of the Lower Sonoran Desert region in summer. While in Vegas Valley, Nev., I was told by the Stuarts, the owners of Vegas Ranch, that a very large bat "with ears like a jackass and a white stripe on each shoulder" is abundant at that place in the summer, but does not occur in spring or fall. They stated that it had not yet arrived at the date of our visit, May 1, 1891.

Genus CORYNORHINUS H. Allen.

1831. *Plecotus* Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, Appendix, p. 431 (not *Plecotus* Geoffroy 1818).

1864. *Synotus* H. Allen, Monogr. N. Am. Bats, p. 62 (not *Synotus* Keyserling & Blasius 1839).

1865. *Corynorhinus* H. Allen, Proc. Acad. Nat. Sci., Phila., p. 173.

1878. *Plecotus* Dobson, Catal. Chiroptera Brit. Mus., p. 177 (part).

1893. *Corynorhinus* H. Allen, Monogr. Bats N. Am., p. 53.

Type species.—*Corynorhinus macrotis* (Le Conte).

Geographic distribution.—Austral zones throughout the United States, and in Mexico south at least to Vera Cruz. Limits of range imperfectly known.

Generic characters.—Dental formula:

$$i, \frac{2-2}{3-3};\quad c, \frac{1-1}{1-1};\quad pm, \frac{2-2}{3-3};\quad m, \frac{3-3}{3-3} = 36.$$

Skull (fig. 8, p. 52) slender and highly arched, the rostral portion relatively smaller and weaker than in any other North American genus of the

family (with the possible exception of *Euderma*, the only known skull of which is now lost). Ears very long, (Pl. I, fig. 9), joined together across forehead, and with tragus free from external basal lobe. Region between eye and nostril occupied by a prominent thickened ridge which terminates in a conspicuous club-shaped enlargement (fig. 7). First phalanx of third finger shorter than second (Pl. III, fig. 2).

General remarks.—*Corynorhinus* differs widely from the other known American genera of *Vespertilionidæ*, but somewhat closely resembles the Old World *Plecotus*. From the latter it is separated by its differ-

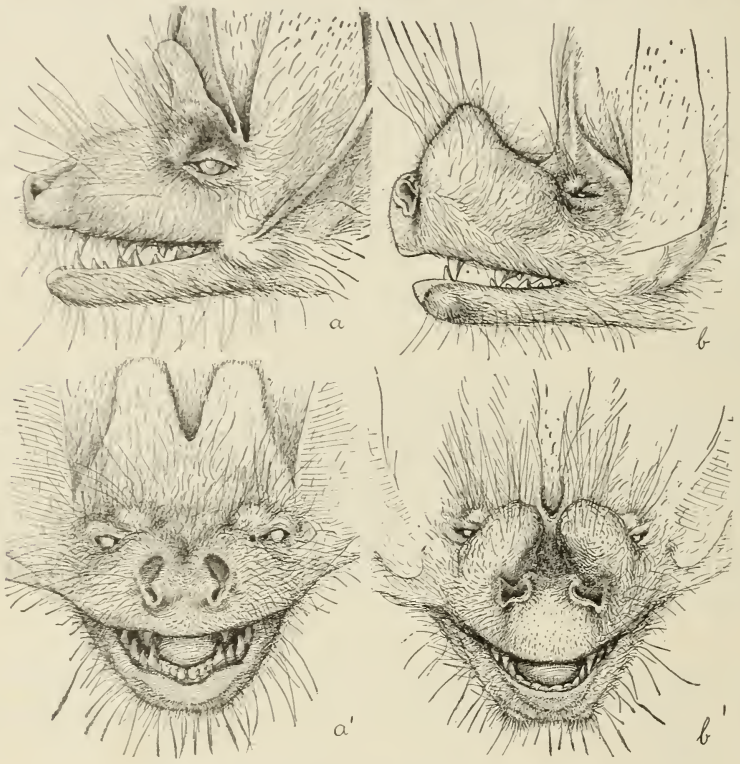

FIG. 7.—Muzzles of (*a*) *Plecotus* and (*b*) *Corynorhinus* (×2).

ently formed nostrils, conspicuously glandular muzzle, and differently proportioned fingers (fig. 7, and Pl. III, figs. 1 and 2). The genus is represented by one species which may be divided into three subspecies, differing from each other chiefly in color. All of these occur in the United States. The material by which this genus is now represented in collections is very unsatisfactory.

KEY TO THE SUBSPECIES OF CORYNORHINUS.

Fur everywhere distinctly bicolor ..... *macrotis* (p. 51)
Fur not distinctly bicolor.
Color yellowish gray ..... *pallescens* (p. 52)
Color blackish brown ..... *townsendii* (p. 53)

CORYNORHINUS MACROTIS (Le Conte). Big-eared Bat.

1831. *Plecotus macrotis* Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, Appendix, p. 431 (Georgia).

1837. *Plecotus leconlii* Cooper, Ann. Lyc. Nat. Hist. N. Y., IV, p. 72. (Name proposed as substitute for *macrotis*.)

1861. *Synotus macrotis* H. Allen, Monogr. N. Am. Bats, p. 63.

1865. *Corynorhinus macrotis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 173.

1893. *Corynorhinus macrotis* H. Allen, Monogr. Bats N. Am., p. 55.

Type locality.—Georgia (see Proc. Acad. Nat. Sci. Phila., 1855, p. 434), probably near the Le Conte Plantation, 5 miles south of Riceboro.

Geographic distribution.—Lower Austral zone in the eastern United States.

General characters.—Size large (forearm 41 mm. to 42 mm., ear about 32); fur everywhere distinctly bicolor; general color yellowish brown.

Ears.—The ears of typical *Corynorhinus macrotis* do not appreciably differ from those of the other subspecies. They are so different from those of all other North American bats as scarcely to require detailed description. They may be instantly recognized by their length, much more than half that of forearm, and by the form of the tragus. This is simple, with a large basal lobe, and wholly free from the auricle. In *Euderma maculatum*, the only other North American bat with ears approaching those of *Corynorhinus* in size, the tragus is joined to the external basal lobe.

Membranes.—The membranes are broad and ample. In texture they are remarkably thin and delicate for so large a bat. Wings (Pl. III, fig. 2) attached at side of metatarsus just below base of toes. Uropatagium extending to extreme tip of tail.

Feet.—The feet are slender, less than half as long as tibiæ, and armed with strong claws. Calcar a little shorter than tibia, and about equal to free border of interfemoral membrane. It is without vestige of keel on posterior border. The termination is obscure and without lobule. Back of toes sprinkled with long bristly hairs.

Fur and color.—The fur is soft and silky, that on middle of back averaging about 12 mm. in length. In distribution it shows no striking peculiarities. It extends a short distance on the dorsal base of the ear, but scarcely reaches the wings or interfemoral membrane.

Back uniform yellowish brown, much as in *Myotis lucifugus;* the hairs everywhere sepia through a little more than the basal half and with very indistinctly pale tips. Belly grayish white; throat and chest darker and more tinged with yellowish. Throughout the ventral surface the fur is very sharply bicolor, the dark bases of the hairs considerably darker than on the back. The light tips are too short wholly to conceal the dark under fur. Ears and membranes light brown.

Skull and teeth.—The skull (fig. 8) and teeth (fig. 9) have been sufficiently described under generic characters. An adult skull from Houma, La. (♀ No. 45894, United States National Museum, Biological Survey collection), measures: Greatest length, 16; zygomatic breadth,

9; breadth of rostrum at posterior border of large premolar, 5; mandible, 10.6; upper tooth row (exclusive of incisors), 5.2; lower tooth row, 6.8.

Measurements.—See table, page 54.

FIG. 8.—Skulls of (*a*) *Corynorhinus townsendii* and (*b*) *C. macrotis* (×2).

Specimens examined.—Total number, 9, from the following localities:

Alabama: Greensboro, 1 (skin, Merriam coll.).
Kentucky: Bowling Green, 1.
Louisiana: Houma, 4 (skins).
Mississippi: Bay St. Louis, 1.
South Carolina: Hardeeville, 1 (skin, Miller coll.).
Virginia: Dismal Swamp, 1 (skin).

General remarks.—Typical *Corynorhinus macrotis*, like the western subspecies, is distinguishable at a glance from all other North American bats by its generic characters. Among the forms of *Corynorhinus* it may be distinguished by its conspicuously bicolored fur. The limits of this animal's range are not well understood, but it is probably a characteristic species of the Austroriparian fauna.

CORYNORHINUS MACROTIS PALLESCENS subsp. nov.

1864. *Synotus townsendi* H. Allen, Monogr. N. Am. Bats, p. 65 (not *Plecotus townsendi* Cooper, 1837), 1893. *Corynorhinus townsendi* H. Allen, Monogr. Bats N. Am., p. 58.

Type from Keam Cañon, Navajo County, Arizona. Adult ♀ (skin), No. 65534, U. S. National Museum (Biological Survey collection). Collected August 3, 1894, by Dr. A. K. Fisher. Collector's No., 1715.

Geographic distribution.—Probably throughout the Austral zones from California, Colorado, and western Texas to southern Mexico.

General characters.—Similar to typical *macrotis*, but much paler in color; fur nowhere distinctly bicolor.

Color.—Back yellowish drab gray, becoming paler about head, the hairs with faintly defined light plumbeous bases and faintly darker tips. Belly slightly paler than back, but hairs without distinctly lighter tips and with darker basal area so ill defined as to be scarcely visible. Ears and membranes light brown.

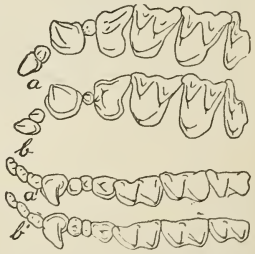

FIG. 9.—Teeth of (*a*) *Corynorhinus townsendii* and (*b*) *C. macrotis* (× 5).

Measurements.—See table, page 54.

Specimens examined.—Total number, 30, from the following localities:

Arizona: Fort Huachuca, 2; Keam Canyon, 1 (skin).
California: Dulzura, 1; Owens Lake, 1; Owens Valley, 1.

Colorado: Larimer County, 1 (skin, Miller coll.).
Guanajuato: Santa Rosa, 17.
Michoacan: Patzcuaro, 1.
Oaxaca: Oaxaca, 1.
San Luis Potosi: Hacienda La Parada, 1.
Texas: East Painted Cave, 1.
Utah: 1.
Vera Cruz: Jico, 1.

General remarks.—*Corynorhinus macrotis pallescens* differs from true *macrotis* in its much paler, more uniform coloration. While this form is represented in the National Museum by numerous specimens in alcohol, the series of skins is very incomplete. Until this series can be greatly increased the limits of distribution of the subspecies must remain purely a matter of conjecture.

The differences in form of the inner upper incisor which have been supposed to distinguish this race from true *macrotis*[1] appear to be inconstant. While the few specimens of typical *macrotis* that I have seen have this tooth without exception bicuspidate, western specimens vary greatly. In a series from Santa Rosa, Guanajuato, both extremes are represented, while several specimens are with difficulty referred to one or the other (fig. 10).

FIG. 10.—Left upper incisors of *Corynorhinus macrotis pallescens* from Santa Rosa, Guanajuato, Mexico.

This is the bat to which Dr. Harrison Allen has applied the name *townsendi*. True *townsendi*, however, the type of which came from the Columbia River, is the dark northwest coast form.

CORYNORHINUS MACROTIS TOWNSENDII (Cooper).

1837. *Plecotus townsendii* Cooper, Ann. Lyc. Nat. Hist., N. Y., IV, p. 73. (Columbia River.)
1878. *Plecotus macrotis* Dobson, Catal. Chiroptera Brit. Mus., p. 180 (not *Plecotus macrotis* Le Conte, 1831).

Type locality.—Columbia River, Oregon.

Geographic distribution.—Humid coast district of Oregon, Washington, and southern British Columbia.

General characters.—Similar to typical *macrotis*, but much darker; fur nowhere distinctly bicolor.

Color.—Back uniform dark brown, the hairs indistinctly light plumbeous at base, and very faintly tipped with yellowish. Belly dark brown, the hairs light plumbeous at base. Ears and membranes blackish.

Measurements.—See table, page 54.

Specimens examined.—Total number, 3, from the following localities:

British Columbia: Comox, 1 (skin).
Oregon: Creswell, 1; Gold Beach, 1.

[1] H. Allen, Monogr. Bats N. Am., p. 58, 1893.

General remarks.—Corynorhinus macrotis townsendii is the dark northwest coast representative of the species. In coloration it bears a close resemblance to the other bats peculiar to the same region. It is so different in general appearance from *macrotis* and *pallescens* that it needs no special comparison with them. More material is necessary before the exact relationship of this form to the others can be determined.

While this is the true *townsendii* of Cooper, it is not the bat to which Harrison Allen has applied the name. The latter is *C. macrotis pallescens*. It was on a specimen of this form from Vancouver Island that Dobson based his description of '*Plecotus*' *macrotis* in the Catalogue of Chiroptera in the British Museum.

Average measurements of subspecies of Corynorhinus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
macrotis	South Carolina: Hardeeville	1 ♀	.....	...	21	10	41	7.4	73	....	....	....
	Kentucky: Bowling Green	1 ♂	105	52	22	10	43.4	7	77	32	23	14
	Lonisiana: Houma	4 ♀♀	106	48.5	21.5	9.4	41.5	7.5	73	32	....	....
pallescens	Arizona: Keam Canyon	1 ♀[1]	105	49	20.6	9.6	42.6	6	76	....	....	....
	Fort Huachuca	1 ♂	95	45	19	9	....	6	71	33.4	21.4	14.6
	Colorado: Larimer County	1 ♀	.....	.....	21.6	9.6	44	7	77	....	....	....
	Texas: East Painted Cave	1 ♀	90	45	21	9.6	41	5	73	33	20	14.6
	Guanajuato: Santa Rosa	10	99.3	48.1	20	9	41.9	6.6	77	33.9	23.7	12.7
townsendii	British Columbia: Comox	1 ♀	.....	.....	21.4	10	42	6.6	76	....	....	....
	Oregon: Gold Beach	1 ♀	105	51	22	9.4	44	7	80	33	24	15
	Creswell	1 ♀	100	48	22	9.8	43	7	77	34	21	14

[1] Type.

Subfamily VESPERTILIONINÆ.

This subfamily contains the great majority of North American *Vespertilionidæ*. Those of its members that occur in the region in question may be known by their simple muzzles and nostrils, separate ears, ample interfemoral membranes, and six incisors in the lower jaw.

KEY TO GENERA OF VESPERTILIONINÆ OCCURRING IN AMERICA NORTH OF PANAMA.

[Based on dental characters only.]

Upper incisors 2.
- Upper premolars 2.
  - Mandibular tooth-row more than 8 mm ..... *Dasypterus* (p. 115)
  - Mandibular tooth-row less than 7 mm.
    - Third lower incisor much smaller than second or first.. *Rhogeëssa* (p. 122)
    - Third lower incisor about equal to second or first .... *Nycticeius* (p. 118)
- Upper premolars 4..... *Lasiurus* (p. 105)

Upper incisors 4.
- Upper premolars 2 ..... *Vespertilio* (p. 95)
- Upper premolars more than 2.
  - Upper premolars 4.
    - Lower premolars 4 ..... *Pipistrellus* (p. 87)
    - Lower premolars 6..... *Lasionycteris* (p. 85)
  - Upper premolars 6..... *Myotis* (p. 55)

Genus MYOTIS Kaup.

1829. *Myotis* Kaup, Skizzirte Entw.-Gesch. u. Natürl. Syst. d. Europ Thierw., I, p. 106. Type *Vespertilio murinus* Schreber (not *V. murinus* Linn.).

1829. *Nystactes* Kaup, Skizzirte Entw.-Gesch. u. Natürl. Syst. d. Europ. Thierw., I, p. 108. Type *Vespertilio bechsteinii* Leisler.

1839. *Vespertilio* Keyserling & Blasius, Wiegmann's Archiv f. Naturgesch., 5ter Jahrg., Bd. 1, p. 306 (not *Vespertilio* Linnæus, 1758).

1841. *Selysius* Bonaparte, Iconografia Fauna Italica, I, Introduzione [p. 3]. Type *Vespertilio mystacinus* Leisler.

1856. *Brachyotus* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 174–177. Based on the species *mystacinus*, *daubentonii*, and *dasycneme*.

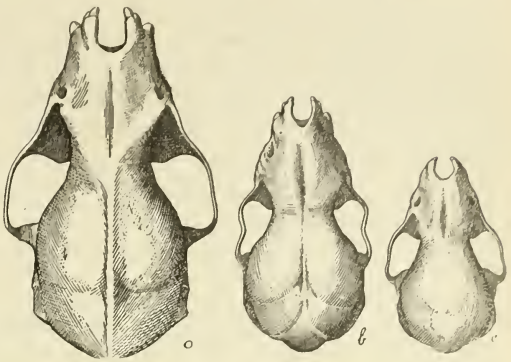

Fig. 11.—Skulls of (*a*) *Myotis myotis*, (*b*) *M. thysanodes*, and (*c*) *M. nigricans* (×2).

1856. *Isotus* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 177–179. Included the species *nattereri* and *emarginatus*.

1864. *Vespertilio* H. Allen, Monogr. N. Am. Bats, p. 46. (Not *Vespertilio* Linn., 1758.)

1870. *Acorestes* Fitzinger, Sitzungsber. Math.-Nat. Cl. K. Akad. Wiss., Wien, LXII, Abth. I, pp. 427–436. Included the species *villosissimus*, *albescens*, and *nigricans*.

1870. *Comastes* Fitzinger, Sitzungsber. Math.-Nat. Cl. K. Akad. Wiss., Wien, LXII, Abth. I, pp. 565–579. (Included *capaccinii*, *megapodius*, *dasycneme* and *limnophilus*.)

1878. *Vespertilio* Dobson, Catal. Chiroptera Brit. Mus., p. 284 (not *Vespertilio* Linnæus 1758).

1893. *Vespertilio* H. Allen, Monogr. Bats N. Am., p. 70. (Not *Vespertilio* Linn., 1858).

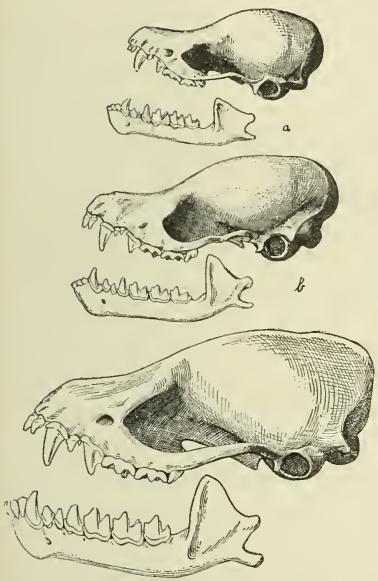

Fig. 12.—Skulls of (*a*) *Myotis nigricans*, (*b*) *M. thysanodes*, and (*c*) *M. myotis* (×2).

Type species.—*Myotis myotis* (Bechstein) = *Vespertilio murinus* Schreber et Auct., nec Linn.

Geographic distribution.—Temperate and tropical parts of both hemispheres.

Generic characters.—Dental formula:

$$i, \frac{2-2}{3-3}; \; c, \frac{1-1}{1-1}; \; pm, \frac{3-3}{3-3}; \; m, \frac{3-3}{3-3} = 38.$$

Remarks.—The North American members of the genus *Myotis* are all small, delicately formed bats, which, aside from their dental formula,

shared by no other American genus of *Vespertilionidæ*, are usually recognizable by their slender forms, long tails, hairy faces, narrow ears, and tapering, straight, or recurved tragi. As I have had no opportunity to study any of the Old World species except *M. myotis*, I can make no attempt to define the genus in detail, but the dental formula, coupled with the characters of the family, is sufficient to distinguish the genus among American bats. The species of *Myotis* differ greatly among themselves, especially in size (see figs. 11 and 12). It may eventually prove necessary to divide the genus into two or more subgenera.

KEY TO NORTH AMERICAN FORMS OF MYOTIS.

Free border of uropatagium conspicuously fringed ..... *thysanodes* (p. 80)
Free border of uropatagium not conspicuously fringed.
  Forearm more than 40 mm.
    Ear when laid forward extending barely beyond nostril ..... *velifer* (p. 56)
    Ear when laid forward extending 7 to 10 mm. beyond nostril ..... *evotis* (p. 77)
  Forearm less than 40 mm.
    Ear when laid forward extending 7 to 10 mm. beyond nostril ..... *evotis* (p. 77)
    Ear when laid forward extending less than 6 mm. beyond nostril.
      Fur on back not distinctly bicolor ..... *nigricans* (p. 74)
      Fur on back distinctly bicolor.
        General color whitish gray.
          Foot 8 to 10 mm ..... *yumanensis* (p. 66)
          Foot 5 to 7 mm ..... *ciliolabrum* (p. 72)
        General color never whitish gray.
          Forearm 30 to 35 mm.
            Color light yellowish gray ..... *californicus* (p. 69)
            Color yellowish brown.
              Forearm 31 to 33 mm ..... *caurinus* (p. 72)
              Forearm 32 to 36 mm ..... *mexicanus* (p. 73)
          Forearm 34 to 40 mm.
            Tibia less than 15 mm ..... *saturatus* (p. 68)
            Tibia 15 to 19 mm.
              Ear and tragus slender, the latter 9 mm. or more in length.
                Color light brown ..... *subulatus* (p. 75)
                Color blackish ..... *keenii* (p. 77)
              Ear and tragus short and broad, the latter 8 mm. or less in length.
                Tibia 17.5 to 20 mm ..... *longicrus* (p. 64)
                Tibia 15 to 17 mm.
                  Ear 12 to 14 mm ..... *lucifugus* (p. 59)
                  Ear 14 to 16 mm ..... *alascensis* (p. 63)

MYOTIS VELIFER (J. A. Allen).

1890. *Vespertilio velifer* J. A. Allen, Bull. Am. Mus. Nat. Hist., N. Y., III, p. 177, Dec. 10, 1890.

1896. *Vespertilio incautus* J. A. Allen, Bull. Am. Mus. Nat. Hist., N. Y., VIII, p. 239, Nov. 21, 1896. (Texas.)

Type locality.—Santa Cruz del Valle, near Guadalajara, Jalisco, Mexico.

Geographic distribution.—Near border line between upper and lower Sonoran zones from Missouri and Indian Territory south to Hidalgo, northern Michoacan, and the City of Mexico.

General characters.—Largest species of *Myotis* known to occur in Mexico or the United States. Length 90 to 105, forearm 40 to 47. Calcar slender, without well-developed lobe. Free border of uropatagium naked. Ears short, reaching tip of nose. Wings from metatarsus.

Ears.—The ears are short and pointed; laid forward they reach to or just beyond nostril. Auricle concave on both sides immediately below the narrowly rounded off tip (most strongly so on the posterior border). Anterior border straight or very slightly convex through the basal two-thirds of its length, then concave or almost straight to tip; posterior border strongly concave directly below tip, then still more strongly convex to basal notch, the widest part of the ear at about mid height. Basal notch well defined, isolating a prominent basal lobe, which is slightly notched on the lower side and joins the side of the face in a line which if continued would coincide with the margin of the upper lip.

Tragus moderately long and broad, the anterior edge straight or very slightly convex toward the tip; posterior border with a well-developed lobe at base; just above the lobe the tragus attains its greatest width; the two borders are usually parallel for a short distance, after which the posterior border bends rapidly forward to the tip, below which it may be either straight or very slightly concave.

Membranes.—The membranes are, for an American *Myotis*, rather thick and opaque. The uropatagium is sparsely haired both dorsally and ventrally on its proximal fourth; the free border, which is distinctly shorter than the calcar, wholly naked. Wing from point between ankle and base of toes, but nearer the latter. When drawn away perpendicularly from the leg, the wing appears to be attached to the ankle.

Feet.—Feet (Pl. II, fig. 6) large and strong, half as long as tibiæ. Toes (without claws) slightly longer than sole, scarcely united by membrane at extreme base, all sprinkled with long, stiff hairs. Calcar long, slender, usually terminating indistinctly, but sometimes with a more or less well-defined lobule at tip.

Fur and color.—There is nothing peculiar about the distribution of the fur to distinguish this bat from other American members of the genus.

In color the fur is dull sepia throughout, paler on the belly, the hairs everywhere dusky slate at base. Individual variation is trifling and is mostly confined to the belly. This is usually dull broccoli brown, but in some specimens by admixture of yellow it becomes more nearly isabella color.

Skull.—Skull stronger and more heavily built than in any other *Myotis* found in Mexico or the United States, but not actually larger than that of *M. thysanodes*. Greatest length (5 specimens) 16 to 16.4; zygomatic breadth, 10 to 11; interorbital constriction, 4 to 4.2; width of rostrum at anterior root of $\frac{m\,1}{}$, 6 to 6.2; length of mandible, 12 to 13. When viewed from above, the brain case is subcircular in outline

but truncate posteriorly and slightly longer than broad. Forehead moderately elevated above muzzle; occiput high and compressed, with well-developed ridges. Distance from posterior border of last upper molar to tip of hamular equal to or less than distance between alveoli of posterior molars.

Teeth.—Upper incisors diverging at tips, the inner tooth of each pair much the larger. First and second premolars in the tooth row or second displaced slightly inward and partly concealed by the anterior edge of the third, the relative size of the two teeth variable, but first always the larger. The second premolar is always much shorter than the first, but the cross section of the crown is sometimes nearly equal in the two teeth. On the other hand, in rare cases the area of cross section in the first is nearly double that of the second. Third upper premolar triangular in outline, posterior margin longest, the outer margin abruptly convex anteriorly, the anterior and posterior borders slightly concave; inner apex of triangle bluntly rounded and not reaching to level of inner margins of molars. Crowns of first and second upper molars trapeziform in outline, the anterior edge longest, and the posterior, outer, and inner edges successively shorter. Anterior edge slightly convex, posterior edge slightly concave. Crown of first molar considerably shorter in proportion to its width than second (fig. 14 *d*, p. 61). Inner mandibular incisors smallest, their crowns compressed and trifid; middle incisors similar but larger; outer incisors about as large as the two others together, their crowns irregularly terete, and with four indistinctly developed tubercles, one of which is much larger than the others. First and second premolars perfectly in line, the first considerably larger than the second, though not much wider in cross section. Third premolar as broad as long, trapeziform, the posterior margin longest.

Measurements.—In the following table average measurements are given of 20 specimens of *Myotis relifer* from six localities.

Average measurements of 20 specimens of Myotis relifer from 6 localities.

Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
Michoacan: Patzcuaro	5	99	44.8	18.5	9.5	45	7.2	73.4	16	10.6	9
Hidalgo: Tulancingo	3	97	42	18.3	8.9	43.6	7.2	71.3	16.1	10.3	8.5
Mexico: Ixtapalapa	1♂	94	40	17.6	8.6	42	6.4	71	15.4	11	9
Arizona: San Bernardino Ranch	4	98.8	42	16.5	9	41.5	6.4	69	------	------	7.8
Texas: San Antonio	1[1]	95.2	44.4	18	8.4	43	7	62	------	------	------
San Antonio	4	93.3	41.3	18.1	9.3	43	6.9	67	------	------	------
Missouri: Marble Cave	3	93.6	39.6	17.9	9.8	42.6	7	69.3	15.6	10.1	8.1

[1] Type of '*incautus*.'

Specimens examined.—Total number 46, from the following localities:

Arizona: San Bernardino Ranch (Monument 77, Mex. Bound. Line), 5 (skins).
Hidalgo: Tulancingo, 4 (1 skin).
Indian Territory: Fort Reno, 3.
Jalisco: Guadalajara, 2 (skins, Merriam Coll.); Santa Cruz del Valle, 3 (skins, Am. Mus. Nat. Hist.); Hacienda San Marcos, Tonila, 1 (skin, Am. Mus. Nat. Hist.).
Mexico: Lerma, 1; Ixtapalapa, 1; City of Mexico, 1 (skin).
Michoacan: Patzcuaro, 11 (3 skins).
Missouri: Marble Cave, Stone County, 3.
San Luis Potosi: Ahualulco, 1.
Texas: Mouth of Pecos River, 4; New Braunfels, 1; San Antonio, 4 (skins, Am. Mus. Nat. Hist., including type of '*incautus*').
Vera Cruz: Las Vigas, 1.

General remarks.—Through the kindness of Dr. J. A. Allen, I have been able to examine two of the original specimens of *Myotis velifer* from Santa Cruz del Valle, Guadalajara, Jalisco, and four specimens (including the type) of '*Vespertilio incautus*' from San Antonio, Texas. After comparing the specimens of '*incautus*' with seven *M. velifer* from various parts of Mexico, I can find no characters to separate the two even subspecifically. In size as well as in cranial and dental characters they agree perfectly, while the difference in color is too slight to be described by words. As the specimens from Mexico were all taken in midsummer and those from Texas were killed in October the variation in color is probably seasonal.

The large size of this bat distinguishes it at a glance from all other Mexican or United States species except *M. thysanodes*. From the latter the darker color, slender calcar, naked free border of interfemoral membrane, and shorter ears and tragus separate it without difficulty.

Myotis velifer, while totally different from all other bats found in Mexico or the United States, is doubtfully distinct from the South American *M. albescens*. Mr. Oldfield Thomas, who has compared for me specimens of the former with the *albescens* in the British Museum so named by Dobson after examination of the type, writes that *M. velifer* and *M. albescens* are practically identical. It is best, however, to retain the name *velifer* for the bat occurring in Mexico and the United States until the South American species has been positively identified.

Dr. Harrison Allen refers to this bat in his recent monograph as *Vespertilio albescens velifer*. Under the same name he mentions a specimen of *M. thysanodes* from 'Dalyura' (=Dulzura), Cal.; while the Texan specimens of *velifer* in the Biological Survey collection he has labeled '*V. albescens?*'

MYOTIS LUCIFUGUS (Le Conte). Little Brown Bat.

1831. *Vespertilio lucifugus* Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, Append., p. 431. (Southern Georgia.)
1856. *Vespertilio subulatus* Le Conte, Proc. Acad. Nat. Sci. Phila. (1854-55), p. 435.
1864. *Vespertilio affinis* H. Allen, Monogr. N. Am. Bats, p. 53.
1864. *Vespertilio lucifugus* H. Allen, Monogr. N. Am. Bats, p. 55.

1878. *Vespertilio carolii* Dobson, Catal. Chiroptera Brit. Mus., p. 325.
1893. *Vespertilio gryphus* Var. (a) *Vespertilio gryphus lucifugus* H. Allen, Monogr Bats N. Am., p. 78.
1893. *Vespertilio albescens affinis* H. Allen, Monogr. Bats N. Am., p. 93.
1897. *Vespertilio lucifugus austroriparius* Rhoads, Proc. Acad. Nat. Sci. Phila., p. 227, May 1897. (Tarpon Springs, Florida.)

Type locality.—Georgia, probably southern Liberty County.

Geographic distribution.—The whole of North America north of the southern boundary of the United States, except in the Rocky Mountains and on the Pacific coast of California, Oregon, Washington British Columbia, and southern Alaska.

General characters.—Size medium; length 80 to 90; forearm 36 to 40; tibia 14.6 to 16.6. Calcar slender, indistinct, about equal in length to free border of uropatagium, usually terminating in a faintly indicated lobule; keel very slightly developed, if at all. Free border of uropatagium naked. Ears short, laid forward they reach about to nostril.

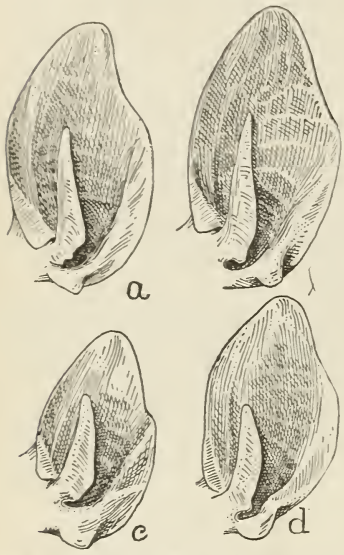

FIG. 13.—Ear of (*a*) *Myotis subulatus*, (*b*) *M. keenii*, (*c*) *M. lucifugus*, and (*d*) *M. alascensis* (×2).

Ears.—The ears (fig. 13, *c*) are short and pointed, reaching when laid forward barely to tip of nose. The anterior border is straight from base through lower third, then for a short distance strongly convex, and finally straight to narrowly rounded off tip. Posterior border gently concave from just below tip to about middle, where it becomes convex and continues so to basal notch. Basal notch moderately developed, isolating a broad but not conspicuous basal lobe.

Tragus short, blunt, bent slightly forward. Anterior border straight or slightly concave from base to tip. Posterior border straight or slightly convex immediately below tip, then more strongly convex to notch above large and prominent basal lobe. Greatest width of tragus through basal lobe or at about middle height, according to convexity of posterior border.

Membranes.—Membranes rather thick and leathery, entirely naked except where fur of body extends in a narrow line at the base of the wings and uropatagium. On the latter the fur occupies about the basal fourth on the dorsal side, rather less ventrally. The wings are attached at the base of the toes.

Feet.—The feet are large and strong, slightly more than half length of tibiæ. Toes longer than sole, joined by membrane at base to a point slightly beyond middle of proximal phalanges. The membrane extends farther on first digit than on fifth.

Fur and color.—The distribution of the fur in *Myotis lucifugus* is in no way peculiar. The hairs are everywhere dusky slate at base. General color dull brown with a distinct gloss in certain lights, the ventral surface paler and more yellowish. The exact shades are variable. Thus in three specimens taken at Washington, D. C., in June, the color of the back is respectively wood brown, raw umber, and sepia, the belly in each pale wood brown tinged to a varying degree with gray. In the majority of individuals the color tends toward sepia. Seven skins from Elk River, Minn., and three from Kadiak Island, Alaska, are indistinguishable in color from those taken at Washington. Ears and membranes light brown.

Skull.—The skull of *Myotis lucifugus* is characterized by the broad

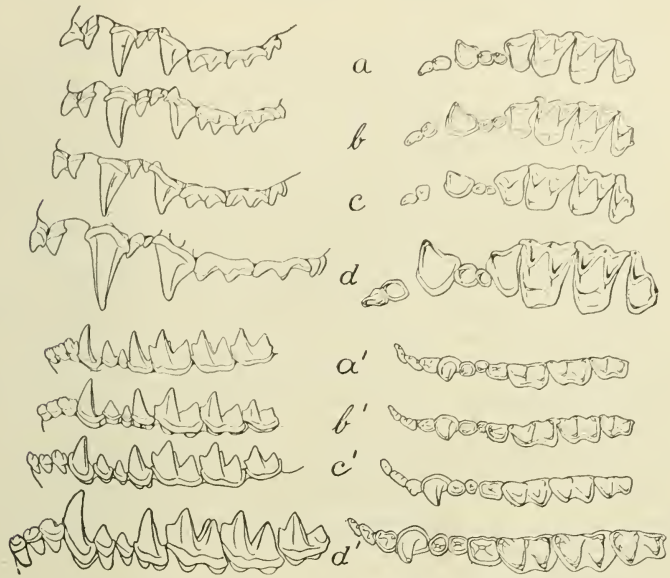

FIG. 14.—Teeth of (*a*) *Myotis yumanensis*, (*b*) *M. lucifugus*, (*c*) *M. lucifugus longicrus*, and (*d*) *M. velifer* (× 5).

muzzle and palate and gradually sloping forehead. In most specimens the face line begins to rise almost from the tip of the muzzle; in others, however, there is a short flat area back of the nasal opening. The brain case is broad and inflated at the back, less so in front, producing in many individuals a wedge-shaped outline. Distance from posterior molar to tip of hamular less than distance between posterior molars.

The skull of *Myotis lucifugus* differs from that of *M. subulatus* in its slightly smaller size, broader palate and muzzle, and less abruptly elevated face line.

Teeth.—Upper incisors diverging at tips (fig. 14 *b*). Crown of first bicuspidate, and, when viewed from below, nearly rectangular and

about twice as long as broad. Larger cusp placed at extreme anterior end; the smaller one on the inner edge near posterior border. Crown of second incisor subterete, unicuspidate. Crown of first premolar longer than second when viewed from the side, slightly larger, or in rare cases very much larger than the latter in cross section; the two teeth in line, or second slightly displaced inward. There is nothing characteristic in the form of the third premolar or of the molars. Maxillary incisors as usual in the genus, the middle pair and the next compressed and trifid, the outer much larger and subterete. First maxillary premolar with crown longer than the second when viewed from the side, and one fourth to one-third larger in cross section; the two teeth perfectly in line, or second slightly displaced inward. Third premolar subquadrate, nearly as broad as long. The lower molars show no distinctive characters.

As compared with *M. subulatus*, the species with which it is most likely to be confused, *Myotis lucifugus* shows numerous differences in dental characters. The tooth row, as a whole, is shorter, and the individual teeth relatively smaller. The first and second premolars in each jaw are actually smaller, and in most specimens more nearly equal in size in cross section. In *M. subulatus* the premolars are so large that the second is often crowded inward from the tooth row, a condition rarely seen in *M. lucifugus*. The form of the third lower premolar is very different in the two species. When viewed from the side, this tooth is conspicuously broader in proportion to its heigh in *M. subulatus*. When viewed from above, the tooth is much larger in *M. subulatus*, and distinctly longer than broad, while in *M. lucifugus* it is nearly as broad as long.

Measurements.—See table, page 65.

Specimens examined.—Total number 562, from the following localities:

Alabama: Greensboro, 1 (skin, Merriam coll.).
Alaska: Kadiak Island, 9.
Connecticut: 1 (Merriam coll.).
District of Columbia: Washington, 20 (majority in Merriam coll.).
Florida: Tarpon Springs, 7 (two skins, Rhoads coll., type and topotypes of '*austroriparius*').
Illinois: Warsaw, 141; West Northfield, 2.
Kentucky: Mammoth Cave, 218.
Maine: Eastport, 1.
Maryland: Seneca River, 1.
Massachusetts: Woods Hole, 1.
Minnesota: Elk River, 7; Fort Snelling, 4.
Newfoundland: Bay St. George, 4 (skins, Bangs coll.).
New York: Adirondacks, 1 (Merriam coll.); Big Moose Lake, 1 (Merriam coll.); Catskill Mountains, 2; Howes Cave, 25 (Merriam coll.); Lake George, 1; Locust Grove, 9 (Merriam coll.); Lyons Falls, 4 (Merriam coll.); Oneida Lake, 63 (Miller coll.); Peterboro, 1 (Merriam coll.); Sing Sing, 1 (Merriam coll.); West Point, 1.
North Carolina: Roan Mountain, 1.
Nova Scotia: Halifax, 1.

Ontario: Gravenhurst, 1 (Miller coll.); James Bay, 2; North Bay, Lake Nipissing, 1 (Miller coll.).
Pennsylvania: Bradford, 1; Center County, 19.
Quebec: Godbout, 1 (Merriam coll.); Ottawa, 2 (Merriam coll.).
South Carolina: Beaufort, 3.
Virginia: Riverton, 1.

General remarks.—*Myotis lucifugus* resembles *M. relifer* more closely than it does any other North American species. From the latter it is, however, readily distinguishable by its much smaller size. From *M. subulatus*, the only species of the genus with which it is associated in the eastern United States, it may be at once recognized by its shorter ear and shorter, less acuminate tragus.

This bat is the *Vespertilio gryphus lucifugus* of Dr. Harrison Allen's recent monograph. Dr. Allen's 'northern form of *Vespertilio gryphus*' is *M. subulatus*.

Through the kindness of Mr. S. N. Rhoads I have examined the type and six topotypes of *Vespertilio lucifugus austroriparius* from Tarpon Springs, Fla. I can find no characters by which these specimens may be distinguished from those taken at other parts of the range of *Myotis lucifugus*. The two skins, one of which is the type, are those of partly grown individuals whose immaturity is clearly indicated by the soft, papery skulls in which the nasal sutures are still clearly visible, and by the imperfectly formed joints of the fingers (see fig. 1, p. 9). These specimens differ from northern adults in smaller size, shorter fur, and duller, browner color. Three adult topotypes in alcohol show only one of these peculiarities—the shortness of fur—and in the fourth this also is absent. The fifth alcoholic specimen is immature. That the adult specimens of *Myotis* from Tarpon Springs are not smaller than *M. lucifugus* from other localities is clearly shown by the table of measurements on page 65. The short fur of three of the adults is evidently a seasonal character, since all showing this peculiarity are in worn, ragged coat, while the only one in fresh pelage (killed September 12) has fur of the ordinary length. The fur of all these specimens, after nearly five years immersion in alcohol, has lost the warm, glossy appearance characteristic of freshly killed individuals. It can be perfectly matched, however, among the series of alcoholic specimens collected in Center County, Pa., during the winter of 1893.

MYOTIS LUCIFUGUS ALASCENSIS subsp. nov.

Type from Sitka, Alaska. Adult ♀ (in alcohol), No. 77416, U. S. National Museum (Biological Survey collection). Collected August 5, 1895, by C. P. Streator. Collector's number, 4754.

Geographic distribution.—Humid coast district of southern Alaska and northern British Columbia.

General characters.—More like typical *lucifugus* than like *longicrus*, but darker in color and with longer ears.

Ears.—As shown in the table of measurements on page 65 the ears of this form average distinctly larger than those of the typical sub-

species. I can not see, however, that they differ appreciably in form (fig. 13*d*).

Fur and color.—The fur is distributed as in true *lucifugus*. In color it is evidently darker than that of the typical form, but the exact differences can not be determined from specimens in alcohol. Ears and membranes blackish.

Measurements.—See table, page 65.

Specimens examined.—Total number 16, from the following localities:

Alaska: Fort Wrangel, 1 (skin, Merriam coll.); Loring, 4 (1 skin); Sitka, 8 (3 skins).

British Columbia: Massett, Queen Charlotte Islands, 3.

General remarks.—*Myotis lucifugus alascensis* is distinguishable from both typical *M. lucifugus* and *M. lucifugus longicrus* by its longer ears and darker color. From *M. lucifugus longicrus* it differs further in its much shorter tibia.

MYOTIS LUCIFUGUS LONGICRUS (True).

1886. *Vespertilio longicrus* True, Science, VIII, p. 588, Dec. 24, 1886.
1893. *Vespertilio nitidus longicrus* H. Allen, Monogr. Bats N. Am., p. 103.
1893. *Vespertilio albescens* (melanic phase) H. Allen, Monogr. Bats N. Am., p. 92 (part).

Type locality.—Puget Sound.

Geographic distribution.—Boreal and Transition zones from Puget Sound east to Wyoming; south at least to Arizona and southern California, and probably much farther.

General characters.—Similar to typical *Myotis lucifugus*, but larger (length, 94 to 102; forearm, 37 to 40; tibia, 17.8 to 19), and with longer tibia and proportionally shorter ear and forearm.

Ears.—The ears are more rounded and proportionally slightly shorter than in typical *M. lucifugus*, the inner side of the conch usually more hairy. Tragus as in *M. lucifugus*.

The membranes and feet differ in no way from those of the true *M. lucifugus*, except that the feet appear shorter in proportion to the tibiæ.

Fur and color.—The fur shows no peculiarities in distribution. In color it is darker and duller than in the typical subspecies (especially in specimens from northern California), but the difference is apparently never very striking, while two skins from Arizona are indistinguishable from specimens of *lucifugus* taken at Washington, D. C.

Skull.—The skull of *Myotis lucifugus longicrus* does not differ appreciably in size or form from that of true *lucifugus*.

Teeth.—In dental characters *Myotis lucifugus longicrus* agrees closely with typical *M. lucifugus*. While there appear to be no constant and important differences between the teeth of the two forms, the third upper premolar averages slightly larger in *longicrus*, and there are usually trifling differences in the relative sizes of the lower premolars (fig. 14*c*).

Measurements.—See table, on page 65.

Specimens examined.—Total number 97, from the following localities:

Arizona: San Francisco Mt., 2; Chiricahua Mts., 1 (skin).
California: Nevada City, 1; Nicasio, 72; Owens Lake, 1; Point Reyes, 1; San Emigdio, 1; Walker Pass, 2.
Chihuahua: San Francisco Water Canyon, San Luis Mts., 1.
Colorado: Grand Junction, 1.
Nevada: Cottonwood Range, 1 (skin); Panaca, 1.
New Mexico: Santa Fe, 1.
Oregon: East base Cascade Mts., near Mt. Thielson, 1 (skin); Beaverton, 2 (Miller Coll.).
Washington: Cape Flattery, 1; Colville, 1; Geyser Basin, 1; Port Townsend, 1.
Wyoming: Lake Fork, 1.

General remarks.—*Myotis lucifugus longicrus* is a well-marked geographical race of *M. lucifugus*, replacing the typical form of the latter in the western United States throughout the region west of the Great Plains. The northern and southern limits of its range can not at present be determined.

A single skin from Cofre de Perote, Vera Cruz, is probably referable to *M. lucifugus longicrus*. The tibia, however, is slightly shorter than in true *longicrus*, and more material from southern localities may show the necessity of recognizing another geographic race.

Myotis lucifugus longicrus is the bat to which the 'melanic form of *Vespertilio albescens*' of Dr. Allen's recent monograph for the most part refers. Under this name, however, Dr. Allen also included dark-colored specimens of *M. californicus*.

Measurements of subspecies of Myotis lucifugus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
lucifugus	Florida: Tarpon Springs	4	89.5	40	16	8.7	38.8	6.2	63.7	13.7	9.4	7.1
	District of Columbia: Washington.	2♀♀	86.5	37.5	....	9	38.9	6.7	....	12.2	9.4	7.5
	Pennsylvania: Centre County	6	85.3	37.6	15.5	7.3	37.6	5.6	60.2	13.3	9.7	7.2
	New York: Howes Cave	10	86.3	38.4	16.5	8.7	38	6.6	61.5	13.2	9.1	8
	Newfoundland: Bay St. George	4♀♀	87.7	37.2	15.5	9	36.7	6.1	61.2	....	....	....
	Alaska: Kadiak Island	6	88.6	38.3	16.1	9.1	36.1	....	....	13.6	8.5	7
alascensis	Sitka	1♀[1]	91	39	16	9	38	6.4	60	16	10.6	8
	Sitka	8♀♀	86.3	38.6	16	8.4	36.6	6.2	59	15.2	9.5	7.6
	Loring	3	80	35	15	8	34.6	6.2	57.6	14.8	8.9	7
	British Columbia: Massett	3	85.6	37.6	16.9	8.9	37	6.2	60	14.9	9.9	7
longicrus	Washington: Puget Sound	1♀	97	44	19	8	38.5	6	65	12	10	7
	California: Nicasio	10	95.3	43.6	18.7	7.7	37.6	5.5	65.3	12	9.8	7.3
	Nevada City	1♀	102	46	19.6	8	39.6	6	71	13	9.8	7.4
	Owens Lake	1♀	96	45	17.8	8.4	....	6	69	12.6	9	7.4
	Walker Pass	2♀♀	97	44.6	18.5	7.4	39.6	6	69	12.6	10	7.4
	San Emigdio	1♀	100	45	18.8	7.6	40	5	69	13.4	9.6	7.4
	Wyoming: Lake Fork	1♂	97	45	19	8	38	7	71	12.6	9	7.4
	Nevada: Panaca	1♂	94	43	18.4	8	39.6	5.6	68	12	9	7.4
	Arizona: San Francisco Mountain	2	93.5	41	17.3	7.7	38.5	6.2	68	13.5	9.5	8.2

[1] Type.

MYOTIS YUMANENSIS (H. Allen).

1864. *Vespertilio yumanensis* H. Allen, Monogr. N. Am. Bats, p. 58.

1866. *Vespertilio macropus* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 288, (nec Gould, 1854).

1893. *Vespertilio nitidus* (pedomorphic variety) H. Allen, Monogr. Bats N. Am., pp. 72, 73.

1893. *Vespertilio albescens* H. Allen, Monogr. Bats N. Am., p. 87, (part, nec Geoff., 1805).

1893. *Vespertilio nitidus macropus* H. Allen, Monogr. Bats N. Am., p. 100.

Type locality.—Old Fort Yuma, California.

Geographic distribution.—Austral zones and lower edge of Transition zone from the southwestern United States to San Luis Potosi and Michoacan, Mexico.

General characters.—Size small; length 74–88; forearm 32–37; calcar distinct, considerably longer than free border of interfemoral membrane, terminating in a well-marked lobule; free border of uropatagium naked: ears moderate; wings from base of toes, but on account of extent of web between toes apparently from side of metatarsus; feet very large and strong as compared with other small American species.

Ears.—The ears (Pl. I, fig. 2) are moderately long; laid forward they reach just beyond the tip of the nose. The anterior border is straight for a short distance at base, then strongly convex, and finally straight or even slightly concave just below tip. The tip is narrow and abruptly rounded off. The posterior border is concave from the tip to the widest part of the auricle, just below mid height, then strongly convex to basal notch, which isolates a well-marked rounded lobe.

Tragus slender, acutely pointed. Anterior border slightly concave at base, then straight or very faintly concave to tip. Posterior border crenulate, straight or slightly concave from tip to broadest point at about lower third. A very large lobe at base; this lobe so large that the greatest breadth of the tragus is often through it.

Membranes.—The membranes, especially the uropatagium, are, for so small a bat, thick and leathery. The interfemoral membrane (Pl. II, fig. 2) is furred at the base, both dorsally and ventrally, but otherwise is naked except for a sprinkling of short hairs along the veins. Wings from base of toes, but on account of the conspicuous webbing of the latter the membrane appears to be attached to the side of the metatarsus.

Feet.—The feet (Pl. II, fig. 2) are, for so small a bat, very large, broad, and strong, more than half as long as the short tibiæ, the whole leg and foot suggesting a small *Nycticeius* rather than a *Myotis*. Toes (without claws) as long as sole, united by membrane at base to distal fourth of proximal phalanges. Calcar strong and distinct, much longer than free border of uropatagium, usually terminating in a distinct lobule. Keel on posterior edge very slightly developed.

Fur and color.—The fur shows no peculiarities in distribution. On the middle of the back it averages about 6 mm. in length.

Color pale wood brown, varying to broccoli brown; belly dirty whitish; the fur everywhere light plumbeous at base; ears and membrane very light brown; the uropatagium and wing membranes edged with whitish.

Specimens from the type locality are the palest that I have seen. Those from Fort Verde, Arizona, and apparently also alcoholic specimens from Tulare and other localities in southern California, are slightly darker, but still very different from *M. yumanensis saturatus*.

Skull.—The skull of *Myotis yumanensis* resembles that of *M. lucifugus* in form, but is distinguished from the latter by its smaller size, and shorter, broader palate. The brain case is broader and flatter than in *M. lucifugus*. From the skull of *M. californicus* that of *M. yumanensis* is readily distinguished by its slightly larger size and very much broader, more robust form, the rostrum in particular being noticeably broader.

Teeth.—The teeth of *Myotis yumanensis* (fig. 14 *a*) more closely resemble those of *M. lucifugus* than any other species. They are, however, smaller, and the crowns of the molars are longer in proportion to their width. The crown of the third lower premolar is only slightly longer than broad, thus resembling the corresponding tooth in *M. lucifugus*, and differing from *M. californicus*, which, like *M. subulatus*, has the crown of this tooth very distinctly longer than broad.

Measurements.—See table, page 69.

Specimens examined.—Total number 142, from the following localities:

Arizona: Fort Verde, 6 (skins); White Mountains, 1 (skin, Am. Mus. Nat. Hist.).

California: Fort Reading, 1; Fort Yuma, 5 (skins); Fresno, 8; Horse Shoe Bend, Colorado River, 1; Keeler, 7; Lone Pine, 2; Mount Whitney, 1; Nevada City, 2; Nicasio, 1; Owens Lake, 5; Owens Valley, 1; Old Fort Tejon, 13; San Luis Rey, 8; Tulare, 45; Walker Pass, Kern County, 1.

Michoacan: Patzcuaro, 13.

Nevada: Pyramid Lake, 1.

San Luis Potosi: Jesus Maria, 7; Hda. La Parada, 3; Ahualulco, 9.

Utah: Provo City, 1.

General remarks.—*Myotis yumanensis* needs comparison with *M. californicus* only. From the latter it is readily distinguished by its much larger foot and longer calcar. More detailed comparison of the two will be found under *M. californicus*.

This is the species to which Dr. Harrison Allen's recent account of *Vespertilio albescens* for the most part refers. His so-called larger melanic form of *albescens* is *Myotis lucifugus longicrus* (True). Specimens of *Myotis californicus*, *M. thysanodes*, and *M. velifer* in the Biological Survey collection have been labeled by Dr. Allen *V. albescens*, the last two, however, with a query. This bat is also the *Vespertilio macropus* and *V. nitidus macropus* of Dr. Allen. The name *macropus*, however, is preoccupied by *Vespertilio macropus* Gould, 1854.[1]

Myotis yumanensis is a much smaller bat than *M. albescens*, and does

[1] Mammals of Australia (*fide* Dobson).

not agree with the descriptions of the latter given by Geoffroy or Dobson. Mr. Oldfield Thomas, after comparing specimens of *M. yumanensis* with the *M. albescens* identified by Dobson in the British Museum, writes me that the two are in no way closely related.

Lack of an adequate series of skins prevents any determination of the extent of individual color variation in this species. Specimens taken at Fort Verde, Arizona, in May and August, are slightly darker than those killed at the type locality in April, while two July skins from Patzcuaro, Michoacan, are nearly as dark as the lightest examples of *M. yumanensis saturatus*.

MYOTIS YUMANENSIS SATURATUS subsp. nov.

Type from Hamilton, Washington. Adult ♂ (skin), No. $\frac{17399}{24306}$, U. S. National Museum (Biological Survey collection). Collected September 13, 1889, by T. S. Palmer. Collector's number, 392.

Geographic distribution.—Transition zone in Oregon, Washington, and British Columbia.

General characters.—Similar to typical *Myotis yumanensis*, but fur longer and color much darker.

Fur and color.—Fur distributed as in the typical subspecies. On the middle of the back it averages about 9 mm. in length. Back dark glossy yellowish brown (the exact shade usually between the 'sepia' and 'mummy brown' of Ridgway's Nomenclature of Colors, Pl. III); belly isabella color; chin, throat, and sides darker than belly; fur everywhere deep blackish plumbeous at base; ears and membranes blackish.

Measurements.—See table, page 69.

Specimens examined.—Total number 19, from the following localities:

British Columbia: Kamloops, 1 (skin); Kultus Lake (near Chilliwack), 1 (skin, Miller coll.); Mount Lehman, 1 (skin, Am. Mus. Nat. Hist.); Port Moody, 1 (skin); Shuswap, 1 (skin); Sumas, 3 (skins, Miller coll.).

Oregon: Crooked River, 1[1]; Lone Rock, 2[1]; Twelve Mile Creek, 1[1].

Washington: Chelan, 3[1]; Hamilton, 2 (skins); Lake Cushman, 1 (skin); Neah Bay, 1.

General remarks.—*Myotis yumanensis saturatus* is readily distinguishable from true *yumanensis* by its much darker color. In this character, however, it closely approaches the typical form of *M. lucifugus*, from which it differs chiefly in smaller general size and much smaller skull. From *M. lucifugus longicrus* it differs very noticeably in its shorter tibia as well as in other characters.

[1] These specimens may be nearer true *yumanensis* than *saturatus*. In alcohol, however, their color appears much too dark for the typical subspecies.

Measurements of subspecies of Myotis yumanensis.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
yumanensis	California: Fort Yuma	4	83.7	35.5	14.1	8.7	32.7	5.2	56.5	.....	.....	.....
	Tulare	10	80.5	36.6	15	8.7	34.2	6	56.4	14.2	9	7.4
	Arizona: Fort Verde	4	79.2	36.7	15.7	8.8	33.9	.....	55.5	14	8.2	7
	San Luis Potosi: Jesus Maria	5♀♀	81	34.9	15.5	7.9	34.4	6.5	57.8	14.4	9.1	7.6
	Michoacan: Patzcuaro	8	80.6	36.3	14.6	8.3	34.1	5.7	57	14.2	9	7.6
saturatus	British Columbia: Sumas	3	82.3	36.5	14	8.6	34.6	5.3	57	.....	.....	.....
	Washington: Chelan	3	77	35	15	8.3	35.3	6	59.3	14.3	8.9	7
	Hamilton	1♂[1]	77	30	15	8.6	33	5	.....	.....	.....	.....

[1] Type.

MYOTIS CALIFORNICUS (Aud. & Bach.).

1842. *Vespertilio californiens* Aud. & Bach., Journ. Acad. Nat. Sci. Phila., p. 280 (California).

1862. *Vespertilio nitidus* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 247 (Monterey, California).

1864. *Vespertilio nitidus* H. Allen, Monogr. N. Am. Bats, p. 60.

1864. *Vespertilio oregonensis* H. Allen, Monogr. N. Am. Bats, p. 61 (Cape St. Lucas and Fort Tejon).

1866. *Vespertilio obscurus* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 281 (Lower California).

1866. *Vespertilio volans* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 282 (Cape St. Lucas).

1866. *Vespertilio exilis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283 (Cape St. Lucas).

1866. *Vespertilio tennidorsalis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283 (Cape St. Lucas).

1866. *Vespertilio yumanensis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283 (nec H. Allen, 1864).

1878. *Vespertilio nitidus* Dobson, Catal. Chiroptera Brit. Mus., p. 318.

1890. *Vespertilio melanorhinus* Merriam, North American Fauna, No. 3, p. 46, Sept. 11, 1890 (San Francisco Mt., Arizona).

1893. *Vespertilio albescens melanorhinus* H. Allen, Monogr. Bats N. Am., p. 91.

1893. *Vespertilio nitidus* H. Allen, Monogr. Bats N. Am., p. 94.

1893. *Vespertilio nitidus henshawi* H. Allen, Monogr. Bats N. Am., p. 103 (Wingate, N. Mexico).

1893. *Vespertilio nigricans* H. Allen, Monogr. Bats N. Am., p. 97 footnote (nec Maximilian 1826).

Type locality—'California.'

Geographic distribution.—Austral zones and lower part of Transition zone throughout the western United States and Lower California, east to Wyoming and Texas. South limit of range not known.

General characters.—Smallest species of *Myotis* known to occur in the United States. Length, 76 to 87; forearm, 30 to 36. Calcar about as long as free border of uropatagium, very slender but distinct and with a more or less well developed lobule at tip, outer edge with a distinct keel. Legs slender, the small feet reaching when extended backward to within about 5 mm. of tip of tail. Free border of uropatagium naked.

Ears moderate, reaching just beyond tip of nose. Wings from base of toes. Fur on back distinctly darker at base than at tip.

Ears.—The ears are moderately long (Pl. I, fig. 2), reaching when laid forward 1 to 3 mm. beyond tip of nose. The anterior border of the auricle is straight or slightly convex at the base, then strongly convex to a point somewhat beyond the middle, after which it is straight or even a little concave to the narrowly rounded off tip. Posterior border concave from tip to point slightly below the middle, after which it is convex to basal notch. Basal lobe strongly developed and notched on its lower border.

Tragus varying much in shape, but with anterior border usually straight, or nearly so, and posterior border strongly convex and with small basal lobe.

Membranes.—The membranes are thin and delicate. Uropatagium (Pl. II, fig. 1) furred on basal third, otherwise naked, except for a few hairs along the veins. Wings from base of toes, naked, except for a narrow strip along side of body.

Feet.—The feet are small and weak (Pl. II, fig. 1), distinctly less than half as long as tibia. Calcar slender but distinct, shorter than free border of uropatagium, usually terminating in a distinct lobule. The posterior border is provided with a keel beginning abruptly about 2 mm. from the base and fading away gradually at about middle of calcar. This keel is supported by 1 to 3 cartilaginous outgrowths from the calcar.

Fur and color.—The fur is soft, full, and long, that on middle of back averaging about 8 mm. in length.

Color light yellowish gray, paler on the belly, the fur everywhere dark plumbeous at base. Membranes, ears, lips, and muzzle blackish.

Skull.—The skull of *Myotis californicus* is smaller and more lightly built than that of any other North American *Myotis*. The brain case is moderately rounded, and the long narrow muzzle fades gradually into the gently sloping forehead. The skull is thus very different from that of *M. yumanensis*, the only species with which *M. californicus* is likely to be confused. In form it resembles the skulls of *M. evotis* and *M. thysanodes*, but the latter are among the largest of the species found in the region inhabited by *M. californicus*.

Teeth.—The teeth of *Myotis californicus* (fig. 15, *a*) are, like the skull, small and delicate. In general they closely resemble the teeth of *M. subulatus*, and differ from those of *M. yumanensis* in numerous details, as in the shape of the third upper molar and third lower premolar, the former being distinctly narrower and the latter longer in proportion to its width than in *M. yumanensis*.

Measurements.—See table, page 74.

Specimens examined.—Total number 152, from the following localities:

Arizona: Camp Grant, 2; Oracle, 5; Prescott, 1 (skin, Am. Mus. Nat. Hist.); Santa Catalina Mountains, 1 (skin); Tinajas Altas, Yuma County, 3; White Mountains, 1 (skin, Am. Mus. Nat. Hist.).

California: Amargosa River, Mohave Desert, 1; Banning, 1; Cahto, 1; Colorado Desert, 1; Death Valley, 14 (including Bennett Wells, 1; Funeral Mountains, 1; Saratoga Springs, 6); Dulzura, 15 (6 skins, Miller coll.); East Fork Kaweah River, 3; Fort Crook, 1; Fort Tejon, 11; Old Fort Yuma, 1; Jacumba, San Diego County, 1; Kern River (25 miles above Kernville), 1; Monterey, 1; Mount Shasta, 1; Nicasio, 7; Petaluma, 1; Point Reyes, 5; San Clemente Island, 3; Santa Barbara, 1; Santa Ysabel, San Diego County, 23; Tejon Pass, 1; Tres Pinos, 1; Twin Oaks, San Diego County, 1; Witch Creek, San Diego County, 7.

Chihuahua: East side of San Luis Mountains, 3.

Lower California: Cape St. Lucas, 2 (*'V. obscurus'* H. Allen); San Fernando, 3 (Miller coll.).

Nevada: Colorado River, 2; Cottonwood Range, 4; Gold Mountain, Esmeralda County, 2; Pahrump Valley, 1; Panaca, Lincoln County, 1; Vegas Valley, Lincoln County, 1.

New Mexico: Fort Defiance, 1; Fort Wingate, 2; Silver City 1 (skin).

Oregon: Elgin, 1; John Day River, 3; Twelve Mile Creek, 2.

Texas: Paisano, 1.

Washington: Almota, Whitman County, 1; Blue Creek, 1; Chelan, 1.

Wyoming: Bitter Creek, Sweetwater County, 2 (skins, Am. Mus. Nat. Hist.); Bull Lake, 1.

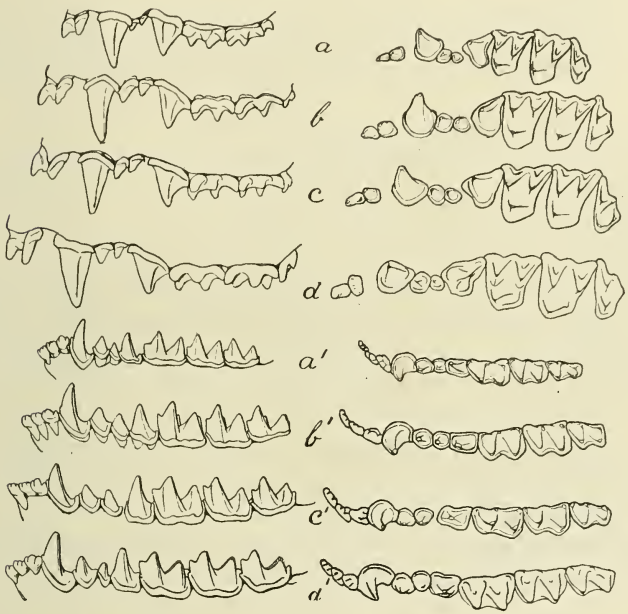

FIG. 15.—Teeth of (*a*) *Myotis californicus*, (*b*) *M. subulatus*, (*c*) *M. evotis*, and (*d*) *M. thysanodes* (× 5.)

General remarks.—Typical *Myotis californicus* varies considerably in color, size, and proportions, but may always be recognized among North American and Mexican species by its small size, slender form, delicate membranes, long tail and legs, small feet, and pale yellowish color. *Myotis yumanensis*, the only other species of equally small size, has conspicuously shorter legs, larger feet, shorter tail, and thicker mem-

branes. The species resembling *M. californicus* in form are all conspicuously larger.

In his recent monograph Dr. Harrison Allen uses the name *Vespertilio nitidus* for *Myotis californicus*. As subspecies of *californicus* he includes *M. yumanensis* (= '*Vespertilio nitidus macropus*'), *M. californicus ciliolabrum*, and *M. lucifugus longicrus* (= '*Vespertilio nitidus longicrus*'). *Vespertilio melanorhinus*, a synonym of *M. californicus*, he, however, refers to '*V. albescens*' (= *M. yumanensis*) as a subspecies, '*Vespertilio albescens melanorhinus*.'

MYOTIS CALIFORNICUS CAURINUS subsp. nov.

Type from Massett, Queen Charlotte Islands, British Columbia. Adult, ♂ (in alcohol), No. 72219, U. S. National Museum (Biological Survey collection). Collected in 1895 by J. H. Keen.

Geographic distribution.—The humid coast district of British Columbia, Washington, and Oregon (possibly also of northern California).

General characters.—Similar to typical *M. californicus*, but very much darker in color.

Ears, membranes, feet, and fur.—As in typical *californicus*.

Color.—Very deep, frequently almost blackish sepia throughout, slightly yellowish on belly, the fur everywhere blackish plumbeous at base.

Measurements.—See table, page 74.

Specimens examined.—Total number, 14, from the following localities:

British Columbia: Port Moody, 1; Massett, 9.
Oregon: Marmot, 1 (skin).
Washington: Fort Steilacoom, 1; Puget Sound, 1; Tenino, 1.

General remarks.—In color *Myotis californicus caurinus* closely resembles dark specimens of *M. californicus mexicanus*. It is readily distinguishable from the latter, however, by its much smaller size.

MYOTIS CALIFORNICUS CILIOLABRUM (Merriam).

1886. *Vespertilio ciliolabrum* Merriam, Proc. Biol. Soc. Washington, IV, p. 1.
1893. *Vespertilio nitidus ciliolabrum* H. Allen, Monogr. Bats N. Am., p. 101 (part).

Type locality.—Trego County, Kansas.

Geographic distribution.—Trego County, Kansas, and central South Dakota. Limits of range wholly unknown.

General remarks.—Similar to typical *M. californicus*, but very much paler in color.

Ears.—In form the ears of *Myotis californicus ciliolabrum* are as in typical *M. californicus*. They average, however, slightly larger.

Membranes.—The membranes are thin and translucent. Wings from base of toes, and entirely naked except a narrow line close to the body. Uropatagium thinly haired on proximal fifth ventrally and on proximal half dorsally, otherwise naked, but with a few hairs along the veins.

Feet.—The feet are moderately large, about half the length of the tibia,

the toes longer than the sole. A distinct wart at heel. Calcar slender, distinct, about equal to free border of interfemoral membrane, terminating in a small but distinct lobule and noticeably keeled along posterior edge. The keel is supported by 1 to 3 cartilaginous processes.

Fur and color.—Except for its unusual extension on the back of the uropatagium the fur shows no peculiarities in distribution.

In color the fur is pale yellowish white throughout. The ears, muzzle, and chin are dark brown in strong contrast. Membranes light brown with pale edges.

Measurements.—See table, page 74.

Specimens examined.—Total number 13, from the following localities:

Kansas: Trego County, 6.
South Dakota: Carroll Draw, Pine Ridge Indian Reservation, 7 (skins Am. Mus. Nat. Hist.).

General remarks.—*Myotis californicus ciliolabrum* is a pale, whitish, race of *M. californicus*, presenting the opposite extreme from *M. c. caurinus*. Except in color, I can not find that it differs in any constant characters from typical *californicus*. The specimens from Grant County, N. Mex., referred to in the original description of *M. c. ciliolabrum* are undoubtedly true *californicus*, as are those from Death Valley referred to this subspecies by Dr. Harrison Allen.

MYOTIS CALIFORNICUS MEXICANUS (Saussure).

1860. *Vespertilio mexicanus* Saussure, Revue et Mag. de Zool., 2e ser., XII, p. 282.
1866. *Vespertilio agilis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 282 (Mirador, Mex.).

Type locality.—Unknown, but probably Vera Cruz, Puebla, or Oaxaca.

Geographic distribution.—Austral and Transition zones in central and southern Mexico (San Luis Potosi, Michoacan, and Oaxaca). Limits of range not known.

General characters.—Slightly larger than typical *Myotis californicus*, and averaging somewhat darker and yellower in color.

Ears, membranes, feet, and fur.—As in typical *californicus*.

Color.—Dull yellowish brown, slightly paler on the belly. Membranes and ears in dry skins blackish. Two immature specimens from Reyes, Oaxaca, are considerably darker than any of the adults, but otherwise a series of thirteen skins shows very little individual variation.

Skull and teeth.—As in typical *californicus*.

Measurements.—See table, page 74.

Specimens examined.—Total number 51, from the following localities:

Michoacan: Patzcuaro, 44 (8 skins).
Oaxaca: Cuicatlan, 1; Reyes, 5 (skins).
San Luis Potosi: Hacienda La Parada, 1.

Average measurements of subspecies of Myotis californicus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
californicus	California: Saratoga Springs	5 ♂ ♂	80	39	14.2	5.4	31.3	4	58	14.2	9.9	8
	Death Valley	5	77.8	38.8	13.9	5.7	31	4.1	55.4	12.9	9.9	8.3
	Arizona: Oracle	5 ♀ ♀	82	39	14.4	6	32	4.2	57	14	10	7.5
caurinus	British Columbia: Massett	1 ♂ [1]	75	34	14	7	32	5	54	12.8	8	7
	Massett	9	77	34.5	13.8	6.1	32.1	4.3	54.1	13.2	9.5	7.1
ciliolabrum	Kansas: Trego County	1 ♀ [1]	75	34	15	7	33	6	59	14	9	8.8
	Trego County	5	80.2	36.7	14.6	6.8	32.8	5.4	57	14.6	10	8.5
mexicanus	Michoacan: Patzcuaro	10	81.5	38.3	14.2	5.9	34.1	4.4	60	14	9.6	7.2

[1] Type.

MYOTIS NIGRICANS (Maximilian).

1826. *Vespertilio nigricans* "Schinz, Thierreich u. s. w., B. I, p. 179" Maximilian, Beiträge zur Naturgesch. v. Brasilien, II, p. 266.

1878. *Vespertilio nigricans* Dobson, Catal. Chiroptera Brit. Mus., p. 319.

1893. *Vespertilio nigricans* H. Allen, Monogr. Bats N. Am., p. 96.

Type locality.—Fazenda de Aga, near the Iritiba River, southeastern Brazil.

Geographic distribution.—Tropical America, north to extreme southern Mexico (Chiapas). Limits of range not known.

General characters.—About the size of typical *Myotis californicus*, but with slightly larger foot and smaller ears; fur on back not distinctly darker at base than at tip.

Ears.—The ears are slightly smaller than in *M. californicus*, but not different in form.

Membranes.—As in *M. californicus.*

Feet.—The feet are relatively larger than in *M. californicus*, but smaller than in *M. yumanensis.* Calcar about as long as free border of uropatagium, terminating in a small but distinct lobe; keel obsolete.

Fur and color.—Fur short, that on middle of back averaging a little less than 6 mm. in length, nearly unicolor on back but distinctly bicolor on belly. Back clove brown (lighter than No. 2 on Pl. III of Ridgway's Nomenclature of Colors), the hairs just perceptibly darker at base and with glossy tips, which in certain lights produce a slightly grizzled appearance. Belly light broccoli brown, the basal half of the hairs deep plumbeous. Ears and membranes blackish in dry skins. A series of ten skins from Huehuetan, Chiapas, shows no variation in color.

Skull.—The skull of *Myotis nigricans* (figs. 11*c* and 12*a*) is slightly smaller than that of *M. californicus*, and has a shorter rostrum and less frontal concavity in the dorsal outline. The differences are slight, but very evident when series are compared.

Teeth.—The teeth of *Myotis nigricans* do not differ appreciably from those of *M. californicus.*

Measurements.—The average measurements of 10 specimens of *Myotis nigricans* from Huehuetan, Chiapas are given in the following table:

Average measurements of 10 specimens of Myotis nigricans.

Locality.	Number of specimens.	Total length.	Tail vertebrae.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
Chiapas, Huehuetan.....	10♀♀	76.7	35	13.6	6.9	33.5	4.4	57	12.7	8.6	6.6

Specimens examined.—Total number, 34; all from Huehuetan, Chiapas (altitude about 300 feet).

General remarks.—*Myotis nigricans* differs from *M. californicus* in numerous characters, each of which is trivial in itself but which with the others goes to make up a sum quite different from that shown by any other North American bat. The constancy in color of the 10 skins by which this species is represented in the Biological Survey collection is very remarkable.

MYOTIS SUBULATUS (Say). Say's Bat.

1823. ? *Vespertilio subulatus* Say, Long's Exped. to Rocky Mts., II, p. 65, footnote (Arkansas River, near La Junta, Colorado).

1864. *Vespertilio subulatus* H. Allen, Monogr. N. Am. Bats, p. 51.

1878. *Vespertilio subulatus* Dobson, Catal. Chiroptera Brit. Mus., p. 324.

1893. *Vespertilio gryphus* var. (b), Northern form of *Vespertilio gryphus*, H. Allen, Monogr. Bats N. Am., p. 80.

1897. *Vespertilio gryphus* var. *septentrionalis* Trouessart, Catal. Mamm. t. Vivent. q. Foss., p. 131. (Only name undoubtedly based on this animal.)

Type locality.—Arkansas River, near La Junta, Colorado.

Geographical distribution.—North America east of the Rocky Mountains.

General characters.—Size medium; length 80 to 90; forearm 34 to 37. Calcar slender, slightly longer than free border of uropatagium, terminating indistinctly or with a slightly developed lobule; keel rudimentary or absent. Free border of uropatagium naked. Ears long, reaching 2 to 5 mm. beyond tip of nose. Wings from base of toes.

Ears.—The ears (fig. 13*a*) are long and slender, reaching when laid forward, 2 to 5 mm. beyond tip of nose. Anterior border straight from base to near middle, then for a varying distance moderately convex, finally straight to narrowly rounded off tip. Posterior border concave from point immediately below tip to about middle, where it becomes convex and continues so to basal notch. Basal notch strongly marked, isolating a narrow and very conspicuous lobe.

Tragus slender, straight, or slightly bent backward. Anterior border straight throughout or slightly convex near tip. Posterior border straight or evenly and slightly concave from tip to widest point, which is opposite or slightly above level of anterior base. Basal lobe small,

width of tragus through lobe always much less than width at base of anterior edge.

Membranes.—The membranes are thin and translucent, naked except for a narrow line close to the body. On the propatagium the furred region occupies the basal fourth dorsally, rather less ventrally, otherwise the membrane is naked except for scattered hairs along the veins. Wings from base of toes.

Feet.—The foot is moderately large, about half as long as tibia. Toes longer than sole, united by membrane at base to a little beyond middle of proximal phalanges, and sprinkled with coarse hairs on dorsal surface. Calcar slender, equal to or slightly longer than free edge of interfemoral membrane, terminating indistinctly or with an ill-defined lobe. Keel rudimentary or absent.

Fur and color.—The fur is full and soft, but shows no peculiarities in distribution. In color it apparently does not differ from typical *M. lucifugus;* but too few skins are now available to determine the limits of variation.

Skull.—The skull of *Myotis subulatus* resembles that of *M. evotis* so closely that it is impossible to distinguish with certainty between the two. In *M. subulatus* the skull is very slightly smaller, but the difference is trifling and intangible. The skull of *M. subulatus* does not closely resemble that of *M. lucifugus.*

Teeth.—The teeth of *Myotis subulatus* (fig. 15 *b*) agree in form and relative size with those of *M. evotis*, and I am unable to find any differences by which to separate them. They differ, however, in many details from the teeth of *M. lucifugus.*

Measurements.—See table on page 77.

Specimens examined.—Total number 53, from the following localities:

Alberta: Near Red Deer, 1 (skin, Miller coll.).
Illinois: Chicago, 1.
Indiana: Brookville, 1; Wheatland, 1.
Kentucky: Eubanks, 2.
Maine: Eastport, 2.
Maryland: Forest Glen, Montgomery County, 2 (Miller coll.).
Massachusetts: Woods Hole, 1.
Minnesota: Elk River, 2.
Missouri: Marble Cave, 9.
New York: Hammondville, 12 (Merriam coll.); Hemlock Lake, 1; Highland Falls, 1; Lake George, 3; Peterboro, 2 (Miller coll.).
Ontario: Mount Forest, 1 (skin, Miller coll.); North Bay, 1 (Miller coll.).
Pennsylvania: Meadville, 1.
Quebec: Godbout, 1 (Merriam coll.); Ottawa, 3 (Merriam coll.).
Tennessee: Bellamys Cave, 1.
Virginia: Alexandria, 1.
West Virginia: Aurora, 2 (Merriam coll.).
Wisconsin: Bayfield, 1.

General remarks.—*Myotis subulatus* may be distinguished from *M. lucifugus*, the only species with which it is likely to be confused, by its narrower skull, longer ears, and longer, more sharply pointed tragus.

MYOTIS SUBULATUS KEENII (Merriam).

1895. *Vespertilio subulatus keenii* Merriam, American Naturalist, XXIX, p. 860, September 1, 1895.

Type locality.—Massett, Queen Charlotte Islands, British Columbia. Type in U. S. National Museum (Biological Survey collection). Adult ♀, No. 72922 (in alcohol).

Geographic distribution.—*Myotis subulatus keenii* is at present known from the type locality only. It doubtless occurs throughout most of the humid northwest coast district.

General characters.—About the size of typical *Myotis subulatus*, but with longer tail and ears; color much darker than in true *subulatus*.

Ears.—The ears of *M. subulatus keenii* (fig. 13 *b*) average distinctly longer than those of typical *subulatus* from the eastern United States, but do not differ in form.

Fur and color.—The fur appears to be longer than in true *subulatus*, and considerably darker in color, but with alcoholic specimens only for comparison it is impossible to determine the degree of difference between the two forms. Membranes and ears blackish.

Measurements.—See table below.

Specimens examined.—Total number 3, all from the type locality.

General remarks.—*Myotis subulatus keenii* is a well-marked race, characterized, like the other bats of the humid northwest coast district, by darkness of color. In addition to its color differences it has longer ears than its eastern representative, in this respect showing much the same variation as *M. lucifugus alascensis*.

Measurements of subspecies of Myotis subulatus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
subulatus	New York: Hammondville	10	85.6	38.8	17.2	7.5	35.7	6.3	61	16.3	10.2	9.7
	Quebec: Godbout	2♂♂	80	36.8	16.4	7.5	33.8	6.5	58	15.6	9.8	9
	Missouri: Marble Cave	8	85.3	38.5	17.1	8	35.3	6.2	61	16.7	10.7	9.3
keenii	British Columbia: Massett	1♀ [1]	86	41	16.4	8.8	36	6	60	17.4	11	9.6
	Massett	3	84.3	40.6	16.3	8.3	35.3	6	58	17.8	10.8	9.8

[1] Type.

MYOTIS EVOTIS (H. Allen). Long-eared Bat.

1864. *Vespertilio evotis* H. Allen, Monogr. Bats N. Am., p. 48.
1878. *Vespertilio evotis* Dobson, Catal. Chiroptera Brit. Mus., p. 324.
1893. *Vespertilio albescens evotis* H. Allen, Monogr. N. Am. Bats, p. 89.
1896. *Vespertilio chrysonotus* J. A. Allen, Bull. Am. Mus. Nat. Hist., VIII, p. 240, November 21, 1896. Kinney Ranch, Sweetwater County, Wyoming.

Type locality.—Not stated, and no type designated. In the original description specimens are mentioned from the upper Missouri River,

and the Pacific coast from Puget Sound to Cape St. Lucas. Monterey, Cal. (one of the localities given), may be selected as the type locality.

Geographic distribution.—Austral and Transition zones from the Pacific Coast to the eastern edge of the Rocky Mountains; south to Vera Cruz.

General characters.—Size large; length 85 to 92; forearm 36 to 43. Calcar longer than free border of uropatagium, slender, distinct, and with a more or less well-developed lobule at the tip. Free border of uropatagium naked or very indistinctly ciliate. Ears very long, reaching 7 to 10 mm. beyond tip of nose. Wing from base of toes.

Ears.—The ears (Pl. I, fig. 6) are long and slender; laid forward they reach considerably (7 to 10 mm.) beyond tip of nose. Anterior border of auricle regularly convex from base to a point slightly beyond middle, thence straight or nearly so to the tip. Posterior border slightly concave immediately below tip of ear, then gradually and moderately convex to base. Basal lobe strongly developed, and notched on the lower border. The auricle is usually marked with three or four distinct cross ridges.

Tragus long, slender, and pointed. The anterior border straight or slightly concave from base to about mid height, then moderately convex, the terminal third or fourth usually straight. Posterior border with a small but distinct lobe at base. Above this lobe the margin bends abruptly outward for a varying distance, sometimes forming a sharp and conspicuous angle with the lower end of the concavity which extends downward from the tip of the tragus, in other cases separated from the latter by a region of varying extent in which the posterior and anterior borders are parallel. These variations bring about striking contrasts in the form of the lower part of the tragus in different individuals, and suggest the existence of more than one species or race. Specimens from approximately the same region, however, show both extremes and intermediate conditions.

Membranes.—The membranes are thin and light. Uropatagium hairy on basal fifth, otherwise naked except for a few hairs along the nerves and on the free border. Wing from base of toes (Pl. II, figs. 3 and 4).

Feet.—The feet are moderately large, slightly less than half as long as tibiæ. Toes (without claws) distinctly longer than sole and united by membrane through basal third of proximal phalanges. Whole dorsal surface of foot sprinkled with stiff hairs. Calcar distinct, equal to or longer than free border of uropatagium, terminating in a lobule of varying distinctness. Posterior border never distinctly keeled.

Fur and color.—The fur is full, soft, and not peculiar in distribution. It is light yellowish-brown, paler ventrally, the hairs everywhere dusky slate at base. The absence of a series of skins of this bat makes it impossible to describe the color accurately or compare it in detail with that of its allies, *M. thysanodes* and *M. subulatus*. A skin from Shuswap, British Columbia, has the fur of the back dull, pale raw umber, the

dusky bases of the hairs showing through along the sides. The belly is light broccoli brown. In front of the shoulder and just below it is a small tawny olive area which contrasts strongly with the color of the belly. In another specimen (No. 1382, collection of Dr. C. Hart Merriam, San Bernardino Mountains, California, August 14, 1885, F. Stephens) the color is similar but a shade paler and yellower throughout, the dark bases of the hairs nowhere showing through. No dark shade in front of shoulder. This specimen is practically indistinguishable in color from the palest examples of *M. thysanodes*, but the fur is much darker at base and the general color is slightly clearer yellow, with the tips of the hairs more glossy. Other skins are duller and less yellow.

Skull.—The skull of *Myotis evotis* equals that of *M. thysanodes* in length and mastoid breadth, but is narrower across zygomata and has the occiput less elevated. The occipital outline is rounded as in *M. thysanodes*, and the occipital crest is very slightly developed. Forehead rising above the muzzle gradually, in this respect also resembling *M. thysanodes*. Rostrum more slender than in *M. velifer* or *M. thysanodes*. Pterygoids and posterior part of palatines as in *M. thysanodes*.

The skull of *Myotis evotis* is easily distinguished from that of all other North American species except *M. subulatus*. From the latter, however, it differs merely in very slightly larger size.

Teeth.—In dental characters *Myotis evotis* does not differ essentially from *M. thysanodes*. The premolars apparently show less tendency to crowding, but I can find no tangible difference in form or relative size (fig. 15 *c*).

Measurements.—The measurements of 8 specimens of *Myotis evotis* from eight localities are given in the following table:

Measurements of 8 specimens of Myotis evotis from 8 localities.

Locality.	Sex.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
Washington: Easton	♂	85	41	19	8	36	7	62	19.4	11.8	10.8
Wyoming: Kinney Ranch	♀[1]	.....	.....	18	8.6	40	7	64	.....	.....	.....
California: Inyo Mountains	♂	89	43	20	7	38	8	63	23	14.6	13
Owens Lake	♀	91	43	17.6	8	38	6.4	63	22	13.4	12.4
San Joaquin River	♂	92	43	19	8	38	6	62	22	13.6	12
Twin Oaks	♀	90	42	18.6	8	37	6.4	62	21	13	11
Nevada: Pahranagat Valley	♀	85	40	18	7.6	36.6	7	62	22	14.6	12
Vera Cruz: Perote	♂	91	42	20	9	40.4	6	67	20	12	11

[1] Type of *Vespertilio chrysonotus* J. A. Allen.

Specimens examined.—Total number 32, from the following localities:

Arizona: Chiricahua Mountains, 1 (skin, Am. Mus. Nat. Hist.); San Francisco Mountain, 1; Springerville, 2 (skins); White Mountains, 2 (skins, Am. Mus. Nat. Hist.).
British Columbia: Shuswap, 1 (skin).
California: Dulzura, 3 (2 skins, Miller coll., 1, Am. Mus. Nat. Hist.); Inyo Mountains, 1; Owens Lake, 1; San Bernardino Mountains, 1 (skin, Merriam coll.); North Fork San Joaquin River, 1; Twin Oaks, San Diego County, 1.
Chihuahua: San Luis Mts., 1 (skin).
Colorado: Loveland, 4 (2 skins, Miller coll.).
Montana: Hot Springs, 1.
Nevada: Cottonwood Range, 1; Pahranagat Valley, 1.
New Mexico: Vermejo River, 1 (skin).
Oregon: Blue Creek, 1; Harney, 1; Twelve Mile Creek, 1.
Vera Cruz: Perote, 1.
Washington: Easton, 1; Colville, 1.
Wyoming: Bull Lake (east of Fremont Peak), 1; Kinney Ranch, Sweetwater County, 1 (skin, Am. Mus. Nat. Hist., type of *V. chrysonotus* J. A. Allen).

General remarks.—*Myotis evotis* is so totally distinct from all other bats occurring in Mexico or the United States that no detailed comparison with any is needed. The only species with which it could be confused are *M. thysanodes* and *M. subulatus*. The ears, however, are much larger than in either of these, and the free border of the uropatagium is never densely haired, as in *M. thysanodes*.

Through the kindness of Dr. J. A. Allen, I have before me the type of *Vespertilio chrysonotus* from Kinney Ranch, Wyoming. I am unable to find that it differs in any way from *Myotis evotis*. The tail is mutilated so that it gives no characters. The forearm is only 2 mm. longe than in the largest *evotis* from the United States that I have seen, a difference too trivial to be taken into account. In color the type of *chrysonotus* is a barely perceptible shade yellower than skins of *evotis* from the San Bernardino Mountains, California, and Vermejo River, New Mexico, but the difference is wholly inconsequential.

MYOTIS THYSANODES sp. nov. Fringed Bat.

1893. *Vespertilio albescens velifer* (variety) H. Allen, Monogr. Bats N. Am., p. 93. Dulzura, California.
1893. *Vespertilio albescens evotis* H. Allen, Monogr. Bats N. Am., p. 90 (part, specimen No. 29827, from old Fort Tejon, California).

Type from Old Fort Tejon, California. Adult ♀ (in alcohol). No. 29827, U. S. National Museum (Biological Survey collection). Collected July 5, 1891, by T. S. Palmer. Original number, 235.

Geographic distribution.—Lower Sonoran zone from near the southern border of the Western United States to San Luis Potosi and Michoacan.

General characters.—In size nearly equal to *Myotis velifer*. Length, 85 to 95; forearm, 40 to 46. Calcar thick and distinct, usually terminating in a well-marked pointed projection. Free border of uropatagium thickened and densely haired. Ears moderately long; laid forward they reach 3 to 5 mm. beyond nostril. Wings from point between ankle and base of toes, but nearer latter.

Ears.—The ears (Pl. I, fig. 5) are moderately long and obtusely pointed; laid forward they reach 3 to 5 mm. beyond the tip of the nose. Anterior border of auricle straight or slightly convex through basal half, then more convex for a short distance, after which it is nearly straight to the rounded tip; posterior border at first straight or slightly concave, sloping rapidly backward to the widest point at about mid-height, below which the border becomes convex and continues so to the well-marked basal notch. Basal lobe distinct and moderately large.

Tragus long and slender, the anterior border straight or slightly concave at base, then straight or slightly convex to near the tip, just below which the border is always convex. Posterior border with a well-developed lobe at base, widest part of tragus through this lobe or immediately above it. A more or less developed notch above the lobe. Beyond this notch the border is at first strongly convex, then slightly concave below the tip, which is thus always bent backward. Posterior border indistinctly crenulate.

Membranes.—The membranes are moderately thick and dark colored. Uropatagium noticeably more leathery than wing membranes, distinctly thickened at free edge, sparsely haired on proximal fourth both above and below, the rest of the membrane with a few scattered hairs, which become more abundant toward the free border, where they form a conspicuous fringe both above and below (Pl. II, fig. 5). Wing from side of foot, just below base of toes.

Feet.—Feet (Pl. II, fig. 5) large and strong, half as long as tibiæ. Toes (without claws) slightly longer than sole, scarcely united by membrane at extreme base; all sparsely haired. Calcar distinct and thick, considerably longer than free border of interfemoral membrane, terminating distinctly, but usually without well-developed lobule.

Fur and color.—There is nothing peculiar in the distribution of the fur in this species, except the thickly haired border of the uropatagium.

In color the fur is everywhere light, dull, yellowish brown, distinctly paler ventrally, the hairs everywhere dusky slate at base. The color is subject to considerable individual variation in shade. The palest specimens are yellowish wood brown inclining to clay color; the darkest specimens dull raw umber. The belly varies from clear gray scarcely tinged with yellow to a strong yellowish gray, and in other specimens to dull brownish gray. The exact shades are very variable and impossible to describe accurately.

Skull.—Skull (fig. 11 *b*, and fig. 12 *b*) large, exactly the same size as that of *M. velifer*, but more lightly built. Brain case oval in outline, abruptly rounded posteriorly, occipital region inflated and lacking well-formed ridges. Forehead moderately elevated above muzzle. Distance from posterior border of last upper molar to tip of hamular greater than width between alveoli of posterior molars.

Although the skull of this species and that of *M. velifer* are equal in size, that of the former is easily distinguished by its more inflated brain

case, forehead more abruptly elevated above muzzle and rounder less angular occiput. When viewed from above, the posterior margin of the brain case is rounded in *M. thysanodes*, truncate in *M. relifer*. When viewed from behind, the brain case in *M. thysanodes* is broader in proportion to its height than in *M. relifer* and lacks the conspicuous occipital crest of the latter. The posterior part of the palate, from the last molars to the tips of the hamulars, is shorter in proportion to the distance between the hindermost molars in *M. relifer* than in *M. thysanodes*.

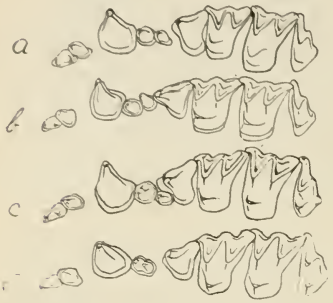

FIG. 16.—Maxillary teeth of four specimens of *Myotis thysanodes*, showing individual variation in form and position of premolars: *a*, specimen from Patzcuaro, Michoacan; *b*, *c*, and *d*, from Hacienda La Parada, San Luis Potosi (×5).

Teeth.—Upper incisors diverging at the tips. First and second upper premolars very variable in relative position and size. The first is always much longer than the second and has the crown at least one-fourth larger in cross section. The cross section of the first may, however, be nearly twice that of the second. In some specimens these two small premolars are perfectly in the line of the tooth row, the first in contact with the canine, the second touching the first, but separated from the third by a distinct space. In others the second premolar while perfectly in line is in contact with the third as well as with the first. Rarely the second premolar lies slightly external to the tooth row, while very commonly it is displaced to a varying degree inward, so much so in some cases as to be almost hidden from the outer side by the close approximation of the first premolar and the anterior edge of the third. These variations are independent of age and sex. The extremes with intermediates of all degrees occur among a dozen of the females collected by Mr. Nelson at Hacienda La Parada, San Luis Potosi, August 16, 1892; while specimens with teeth much worn or wholly unworn may have the premolars indifferently greatly crowded and displaced or wholly in the tooth row (fig. 15 *d*, fig. 16, and fig. 17.)

FIG. 17.—Abnormal premolar of *Myotis thysanodes* (No. 52228): *a*, crown; *b*, side (×20).

Third premolar triangular in outline, the outer border abruptly convex in front, and equal to posterior border; anterior and posterior borders concave; inner apex rounded, not extending back to level of inner margins of molars. First and second molars trapeziform, the anterior edge longest, the posterior outer and inner margins successively shorter. Anterior border straight to near inner edge, where it is bent abruptly backward, posterior border very slightly concave. First molar shorter and broader than second, and with anterior border nearly straight.

Central lower incisors with crowns compressed and trifid, the next pair similar but larger, the outer incisors still larger and with crowns indistinctly terete and quadrituberculate. First and second mandibular premolars variable in position and in relative size, the first always the larger. The second is shorter than the first, but in some specimens its crown has a cross section nearly equal to that of the latter. The first is always in contact with the canine and usually with the second premolar also, but may be separated from the latter by a narrow space. The second premolar is either wholly in the line of the tooth row and not touching the third, in line and touching the latter, or more or less displaced inward. Third premolar trapeziform, slightly broader than long.

In dentition *Myotis thysanodes* shows many points of difference from *M. velifer*. One of the most striking of these is the great variability in the size and position of the first and second upper premolars (figs. 16 and 17), which in *M. velifer* are comparatively constant. Other differences may be seen in the form of the third upper and third lower premolars. The crowns of the upper molars are proportionally broader in *M. velifer* than in *M. thysanodes*.

Measurements.—Average measurements of 23 specimens of *Myotis thysanodes* from four localities are given in the following table:

Average measurements of 23 specimens of Myotis thysanodes from 4 localities.

Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
California: Old Fort Tejon	[1]1	87	36	18	8	41	6	69	18	12	11
Old Fort Tejon	10	87	37	17.6	8	41.2	6.3	69.2	17.6	11.8	10.5
Michoacan: Patzcuaro	3	89	37	16.7	8.9	41.8	6.7	71.5	18.3	11.9	10.8
San Luis Potosi: Hda. La Parada	10	90.4	36.9	17.4	8.9	42.7	6.7	73.6	18.5	12.2	10.5

[1] Type.

Specimens examined.—Total number 88, from the following localities:

California: Dulzura, 1 (skin, Miller coll.); Old Fort Tejon, 16.
Chihuahua: East side San Luis Mountains, 2 (skins).
San Luis Potosi: Hacienda La Parada, 62 (6 skins).
Michoacan: Patzcuaro, 5 (2 skins).
Jalisco: La Laguna, Sierra de Juanacatlan, 1 (skin); Sierra Nevada de Colima, 1 (skin, Am. Mus. Nat. Hist.).

General remarks.—*Myotis thysanodes* needs no close comparison with any other species occurring in Mexico or the United States. Its large size separates it from all others but *M. velifer*, while from the latter the ciliated free border of the uropatagium, peculiar thickened calcar, larger ears and paler color together with the cranial and dental characters readily distinguish it.

In certain respects *M. thysanodes* resembles *M. evotis*. The color is very much the same, while the ears in these two species reach their maximum development among the species of this genus found in North America. The free border of the interfemoral membrane in *M. evotis* shows a slight tendency to the ciliation so conspicuous in *M. thysanodes*. *Myotis evotis* is, however, a smaller animal and has ears proportionally longer than in *M. thysanodes*, while the free border of the interfemoral membrane is never distinctly ciliate.

That this species is the same as the South American *Myotis albescens* is exceedingly unlikely. Dobson, who has seen the type of the latter, gives for it the following characters, which do not in the least apply to the present species: "Ears shorter than the head; laid forward, the tips do not reach to the end of the muzzle; calcaneum feeble, termination indistinct; above dark brown." Moreover, Mr. Oldfield Thomas, who has compared specimens of *Myotis thysanodes* with the *albescens* in the British Museum, writes me that the two do not in the least resemble each other, and that *M. albescens* is allied rather to *M. velifer*. For further discussion of the question, see under the latter species.

In Dr. Harrison Allen's recent monograph (p. 93) a specimen of this species in my collection, taken at Dulzura, [misspelled Dalyura], Cal., is recorded as a variety of '*V. albescens velifer*.' A specimen from Old Fort Tejon, California, in the Biological Survey collection, is labeled by Dr. Allen '*V. subulatus*,' while fifteen others of the same species from the same locality are marked '*V. albescens?*.' One of the latter (No. 29827), however, is recorded as '*V. albescens evotis*' (p. 90).

Dr. T. S. Palmer has kindly furnished me with the following account of the colony from which the type of *Myotis thysanodes* was taken:

> In July, 1891, while one of the parties of the Death Valley Expedition was collecting at Old Fort Tejon, California, several species of bats were observed. The most abundant was a small *Vespertilio* [=*Myotis*], which could be seen at dusk flying about the oak trees near the old barracks in great numbers, and passing in and out of the ruined buildings. A long two-story adobe building, with the roof still intact, seemed to be the center of attraction, and about sundown bats could be seen streaming forth from a window in one of the gables. On the morning of July 5 an examination was made of the attic of this building, and the bats were found clinging to the ridgepole and the rafters, literally by thousands. Individuals of all ages, from recently born young to adults, were hanging together in bunches as big as a bushel basket. Others found concealment in cracks and crevices, but very few were flying about. Evidently the colony had occupied the attic for several years, but it was too dark to see whether more than one species was present.
>
> A sack was carried along under the ridgepole and specimens swept into it from several of the larger bunches. In this way more than a hundred bats were collected in a few minutes. As soon as they were disturbed they uttered a peculiar squeaking note and flew about in a confused manner in their efforts to escape. The sack was carried out under one of the oak trees and the specimens examined; 160 had been captured, and of these 25 were preserved[1] and the remainder allowed to escape. Some of the bats which had been given their liberty attempted to fly back to their retreat, but dazed by the sunlight took refuge in the branches of the nearest tree;

[1] Sixteen proved to be *Myotis thysanodes;* the others were *M. yumanensis*.

others made no attempt to escape, except to crawl up the trunks of the trees, where they remained until dark. Some of the young ones failed to find their way back to the building, and remained about the spot for several days.

Genus LASIONYCTERIS Peters.

1864. *Scotophilus* H. Allen, Monogr. N. Am. Bats, p. 27 (part, not *Scotophilus* Leach, 1821).

1865. *Lasionycteris* Peters, Monatsber. K. Akad. Wiss. Berlin, p. 648. Type *Vespertilio noctivagans* Le Conte.

1870. *Cnephaiophilus* Fitzinger, Sitzungsber. K. Akad. Wissensch., Wien, LXII, Abth., I, p. 8 (part).

1875. *Vesperides* Coues in Coues' and Yarrow's Zoology of Wheeler's Exped., p. 83. Type *Vespertilio noctivagans* Le Conte.

1878. *Vesperugo* Dobson, Catal. Chiroptera Brit. Mus., p. 183 (part).

1893. *Lasionycteris* H. Allen, Monogr. Bats N. Am., p. 104.

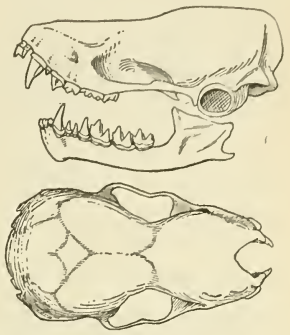

FIG. 18.—Skull of *Lasionycteris noctivagans* (×2.)

Type species.—*Lasionycteris noctivagans* (Le Conte).

Geographic distribution.—The range of the genus *Lasionycteris* is the same as that of the type and only known species.

Generic characters.—Dental formula: $i, \frac{2-2}{3-3}$; $c, \frac{1-1}{1-1}$; $pm, \frac{2-2}{3-3}$; $m, \frac{3-3}{3-3} = 36$.

Skull (fig. 18), flattened; rostrum very broad in proportion to brain case, strongly concave on each side back of the nasal aperture; dorsal profile of skull nearly straight and sloping gradually from external nares to occiput, which is scarcely angular, and always without sagittal crest. Ears short, nearly as broad as long; when laid forward, reaching barely to nostril; basal lobe very large. Tragus short, straight, and bluntly rounded at tip, width much more than half length of anterior margin. Back of interfemoral membrane furred on basal half. Mammæ, 2.

FIG. 19.—Teeth of *Lasionycteris noctivagans* (×5).

General remarks.—Among the American *Vespertilionidæ* the genus *Lasionycteris* is readily distinguished by its dental formula, combined with its short, broad ears, broad tragus, and partially furred uropatagium.

The genus *Lasionycteris* is peculiar to North America, where it is represented by one widely distributed species whose characters are remarkably constant throughout its range.

LASIONYCTERIS NOCTIVAGANS (Le Conte). Silver-haired Bat.

1831. *Vespertilio noctivagans* Le Conte, McMurtrie's Cuvier's Animal Kingdom, I, p. 31, June, 1831.

1831. *Vespertilio auduboni* Harlan, Monthly Amer. Journ. Geol. and Nat. Hist., I, p. 220, Pl. II, November, 1831 (Philadelphia, Pa.).

1835. *Vespertilio pulverulentus* Temminck, Monogr. de Mammalogie, II, p. 325 (Missouri River).

1864. *Scotophilus noctivagans* H. Allen, Monogr. N. Am. Bats, p. 39.

1865. *Lasionycteris noctivagans* Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 648.

1878. *Vesperugo noctivagans* Dobson, Catal. Chiroptera Brit. Mus., p. 238.

1893. *Lasionycteris noctivagans* H. Allen, Monogr. Bats N. Am., p. 105.

Type locality.—Eastern United States.

Geographic distribution.—North America, from Atlantic to Pacific; probably not breeding south of the Transition Zone.

General characters.—See generic characters given on page 85.

Color.—The fur is deep, blackish, chocolate brown throughout, many of the hairs on the back, belly, and furred part of interfemoral membrane tipped with silvery white. The white tips are most numerous on middle of back. They are absent, or nearly so, from face, crown, and throat.

Skull and teeth.—The cranial and dental characters of *Lasionycteris noctivagans* have been sufficiently described in the diagnosis of the genus.

Measurements.—The average measurements of 21 specimens of *Lasionycteris noctivagans* from eight localities are given in the following table:

Average measurements of 21 specimens of Lasionycteris noctivagans from 8 localities.

Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
New York: Sing Sing	10	105.8	42.4	17.1	7.9	41.1	5.3	73.4	15.9	14.1	6.7
Montana: Flathead Lake	2♀♀	100.5	41	16.2	7.5	42	4.5	75	15.6	14.1	6.2
Colorado: Rifle	1♂	97	38	16	8	39	4.6	68	16	12	6
Nevada: Badger	2♀♀	95.5	32.5	16	8.4	40	6.2	.....	15.8	11.8	6
Oregon: Blue Mountains	1♂	97	39	16.4	8	41	6	.....	15.4	11	5.6
Crooked River	1♂	95	41	17	7	41.4	5	.....	16	12	6
Elgin	3	101	43	16.3	8.9	43	4.3	.....	16	13.3	5.7
Harney	1♂	98	44	15	8.6	41	6	.....	16	13	6

Specimens examined.—Total number 105, from the following localities:

Alberta: Henry House 2 (skins).
British Columbia: Sumas, 1 (skin, Miller coll.).
California: Nevada City, 1; Nicasio, 2.
Colorado: Rifle, 1.
Massachusetts: Nantucket, 1; North Truro, 6 (skins, Miller coll.).
Montana: Flathead Lake, 2.

Nebraska: Platte River, 1.
Nevada: Badger, 2.
New York: Lake George, 6 (2 skins); Leyden, 14; Locust Grove, 4; Lyons Falls, 4; Sing Sing, 47 (26 young).
North Carolina; Magnetic City, 1 (skin).
Oregon: Beaverton, 1 (skin, Miller coll.); Blue Mountains, 1; Crooked River, 1; East base Cascade Mountains, near Mount Thielson 1 (skin); Elgin, 3; Harney, 1; Salem, 1.
Pennsylvania: Carlisle, 1.

General remarks.—Lasionycteris noctivagans is one of the most easily recognized of North American bats. Its peculiar color alone is sufficient to distinguish it from all others found in the region where it occurs.

Genus PIPISTRELLUS Kaup.

1829. *Pipistrellus* Kaup, Skizzirte Entwick.-Gesch.,u. Natürl. Syst. d. Europ. Thierw., Th. I, p. 98. Type *Vespertilio pipistrellus* Schreber.
1839. *Vesperugo* Keyserling & Blasius, Wiegmann's Archiv f. Naturgesch., 5ter Jahrg., Bd. 1, p. 312 (part).
1856. *Nannugo* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge II, 131, 169–172. Based on *nathusii, pipistrellus,* and *kuhlii.*
1856. *Hypsugo* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 167–169. Included the species *maurus* and *kraschenikowii.*
1864. *Scotophilus* H. Allen, Monogr. N. Am. Bats, p. 27 (part, not *Scotophilus* Leach).
1878. *Vesperugo* Dobson, Catal. Chiroptera Brit. Mus., p. 183 (part).
1893. *Vesperugo* H. Allen, Monogr. Bats N. Am., p. 121.

Type species.—Pipistrellus pipistrellus (Schreber).

Geographic distribution of genus.—The greater part of the Eastern Hemisphere, and throughout the southern half of North America. Exact limits of distribution not known.

Generic characters.—Dental formula:

$$i, \frac{2-2}{3-3};\ c, \frac{1-1}{1-1};\ pm, \frac{2-2}{2-2};\ m, \frac{3-3}{3-3} = 34.$$

Skull (figs. 21 and 22) small and lightly built, varying somewhat in form among the different species. Braincase usually more inflated than in *Vespertilio* and *Lasionycteris*, but rostrum proportionally as broad as in these genera. Ears (fig. 20) distinctly longer than broad and tapering to a narrowly rounded tip. Tragus straight or slightly curved forward. Back of interfemoral membrane sprinkled with hair on basal third. Mammæ, 2.

General remarks.—The members of the genus *Pipistrellus* may be recognized by their dental formula and small size. The bats of the European genus, *Pterygistes*[1] (*Pterygistes noctula* and *P. leisleri*), which have the same dental formula, are large, heavily built, and altogether different in appearance.[2]

[1] *Pterygistes* Kaup, Skizzirte Entwick.-Gesch. u. Naturl. Syst. d. Europ. Thierw., Th. I, p. 100, based on *Vespertilio proterus* Kuhl (=*V. noctula* Schreber) and *V. leisleri* Kuhl.

[2] For remarks on the generic characters of '*Noctulinia*' (=*Pterygistes*), see H. Allen, Proc. U. S. Nat. Museum, 1893, p. 30.

In America the genus is represented by three species, all of which are strictly congeneric with *Pipistrellus pipistrellus*. Of the American species *P. subflavus* resembles *P. pipistrellus* most closely, but is distinguishable at a glance by its much longer thumb.

KEY TO AMERICAN FORMS OF PIPISTRELLUS.

Tragus blunt with tip bent forward:
- Forearm about 31 mm.; colors very pale ..... *hesperus* (p. 88)
- Forearm about 28 mm.; colors darker ..... *australis* (p. 90)

Tragus tapering and straight:
- Forearm 30 to 32 ..... *veraecrucis* (p. 93)
- Forearm 33 to 36—
  - Color yellowish brown ..... *subflavus* (p. 90)
  - Color drab brown ..... *obscurus* (p. 93)

PIPISTRELLUS HESPERUS (H. Allen).

1864. *Scotophilus hesperus* H. Allen, Monogr. N. Am. Bats, p. 43.
1878. *Vesperugo hesperus* Dobson, Catal. Chiroptera Brit. Museum, p. 228.
1886. *Vesperugo merriami* Dobson, Ann. & Mag. Nat. Hist., 5th ser., XVIII, p. 124.
1893. *Vesperugo hesperus* H. Allen, Monogr. Bats N. Am., p. 128.

Type locality.—Fort Yuma, Cal. Type No. 5406, U. S. National Museum.

Geographic distribution.—Lower Austral zone in the Western United States from western Texas to the Pacific Coast. Limits not known.

General characters.—Size very small (forearm about 26); thumb short (about one-eighth of forearm); ear shorter and more bluntly rounded than in other American members of the genus, reaching barely to nostril when laid forward; tragus blunt and distinctly bent forward at tip; feet very small, about half as long as tibia; barely 1 mm. of tip of tail free from membrane; color very pale.

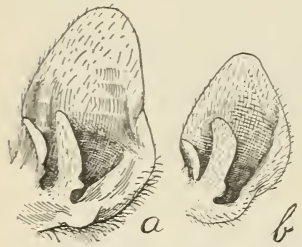

FIG. 20.—Ear of (*a*) *Pipistrellus subflavus* and (*b*) *P. hesperus* (×2).

Ears.—The ears (fig. 20 *b*) are short, reaching barely to nostril when laid forward. The anterior border of auricle is strongly convex from well developed basal notch to region about middle, where it becomes straight and remains so almost to narrowly rounded tip. Posterior border concave immediately below tip, then strongly convex to basal notch. Basal lobe well developed, separated from auricle by a deep notch and joining face at point below line of lips, and slightly behind posterior corner of eye. The fur of the head extends over dorsal surface of ear to slightly beyond the basal third. Otherwise the ear is naked except for a sprinkling of fine hairs on inner surface.

Tragus less than half length of ear, broadest just below tip; anterior border straight throughout greater part of its length, but strongly concave immediately below tip; posterior border strongly convex from tip almost to notch above well developed basal lobe.

Membranes.—The membranes are thin and delicate. Uropatagium very sparsely furred at extreme base, otherwise naked except for a few scattered hairs which are most numerous on the basal half. Wing

membranes attached at base of toes. Uropatagium extending almost to extreme tip of tail.

Feet.—Foot small, distinctly less than half as long as tibia, naked or with a few almost invisible whitish hairs on dorsal surface. Calcar about as long as tibia, scarcely keeled on posterior edge, terminal lobe absent or very indistinct.

Fur and color.—The fur extends on basal third of ears, but barely reaches extreme base of interfemoral membrane, and on wing membranes invades merely a very narrow strip close to body.

Color light yellowish gray or whitish gray, the fur everywhere deep plumbeous at base. In some specimens the hairs on the back have faint dark subterminal areas which, however, are visible on close inspection only. Ears, muzzle, face, and membranes black. A narrow whitish border on wing membrane between foot and fifth finger.

This species is apparently much more constant in color than *P. subflavus*, but the absence of a good series of skins leaves the range of individual variation in color a matter of uncertainty.

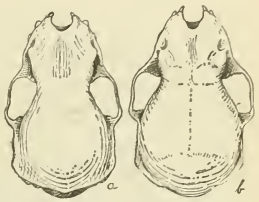

FIG. 21.—Top view of skull of (*a*) *Pipistrellus hesperus* and (*b*) *P. subflavus* (×2.)

Skull.—The skull of *Pipistrellus hesperus* (figs. 21 *a*, and 22 *b*) is very small, thin, and papery. That of an adult male from Fort Bowie, Arizona, measures 11.4 mm. in occipitonasal length, 6 mm. in zygomatic breadth, and 4 mm. in occipital depth. The dorsal outline is nearly straight from external nares to occiput, though there is a slight concavity between the orbits and a slight convexity over the brain case. Muzzle broad and nearly flat, slightly concave on each side of median line. In general the skull of *Pipistrellus hesperus* suggests a miniature of that of *Lasionycteris*.

Teeth.—The teeth of *Pipistrellus hesperus* (fig. 23 *a*) do not differ materially from those of *P. subflavus*. The anterior upper premolar is minute (much smaller than the smaller upper incisor) and usually thrown out of the tooth row by the second premolar, the anterior edge of which is generally in contact with the canine.

Measurements.—See table, page 95.

Specimens examined.—Total number 127, from the following localities:

Arizona: Beaverdam, 1; Fort Bowie, 1 (skin); Grand Cañon, 2; Guadalupe Cañon, Cochise County, 4 (skins); Little Colorado, 2; Dos Cabezas, 1 (skin); Keam Cañon, Navajo County, 1 (skin); New River, Maricopa County, 1; Yuma, 2.

California: Borax Flat, Mohave Desert, 3; Colorado Desert, 1 (skin); Death Valley, 4; Funeral Mountains, Inyo County, 1; Furnace Creek, Death Valley, 1; Grapevine Spring, Death Valley, 1; Independence, 1; Hot Springs Valley, Inyo County, 2; Jacumba, San Diego County, 2 (skins); Keeler, 1; Kern River, 3; Kernville, 1; Lone Pine, 3; Owens Lake, 1; Palm Springs, 3; Panamint Valley, Inyo County, 6; Panamint Mountains, 4; Poso Creek, Kern County, 1 (skin); Saline Valley, Inyo County, 1; San Emigdio, 1; Santa

Ysabel, San Diego County, 18; Three Rivers, 7; Twin Oaks, 2; Vallecitas, San Diego County, 3; Whitewater, 1 (skin); Yosemite Valley, 1; Old Fort Yuma, 1 (type).

Colorado: Grand Junction, 4.

Lower California: San Fernando, 7 (Miller coll.).

Nevada: Gold Mountain, Esmeralda County, 1; Pahranagat Valley, 1; Vegas Mountains, 1; Vegas Valley, Lincoln County, 1.

New Mexico: Dog Spring, Grant County, 7 (skins); Fort Wingate, 1; Grant County, 1 (skin).

Texas: Chinate Mountains, 1: El Paso, 1 (1 skin); Paisano, 5; Pecos River, 1.

Utah: St. George, 2.

Washinton: Almota, 1.

General remarks.—*Pipistrellus hesperus* is readily distinguishable among North American bats by its dental formula, small size, blunt tragus, and pallid color. It needs no comparison with any other species. At the southernmost extremity of its known range a subspecies slightly different from that occurring farther north has been differentiated. Otherwise the species is remarkably constant in all its characters.

PIPISTRELLUS HESPERUS AUSTRALIS subsp. nov.

Type from Barranca Ibarra, Jalisco, Mexico; altitude about 3,000 feet. Adult ♀ (in alcohol), No. 52112, U. S. National Museum (Biological Survey collection). Collected May 14, 1892, by E. W. Nelson. Original number, 2614.

General characters.—Slightly smaller than true *Pipistrellus hesperus;* fur shorter; color apparently darker and browner.

Ears, membranes, and feet.—As in the typical subspecies.

Fur and color.—The fur is shorter than in specimens of true *hesperus* taken in April and May, but in distribution it shows no peculiarities.

Color darker and browner than in specimens of true *hesperus* that have been immersed in alcohol for a similar length of time. Until skins of the southern animal are examined the actual color differences between the two forms can not be determined.

Measurements.—The measurements of the type and the averages of four specimens from the type locality are given in the table of measurements on page 95.

Specimens examined.—Four, all from the type locality.

General remarks.—*Pipistrellus hesperus australis* is a fairly well marked subspecies characterized by slightly smaller size, shorter fur, and darker color than in the typical form. The material by which it is represented is so poor, however, that all the characters can not be determined with certainty.

PIPISTRELLUS SUBFLAVUS (F. Cuvier). Georgian Bat.

1832. ?*Vespertilio georgianus* F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, p. 16. (Not determinable.)

1832. *Vespertilio subflavus* F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, p. 17. (Description good.)

1835–41. *Vespertilio erythrodactylus* Temminck, Monogr. de Mamm., II, 13mo Monogr., p. 238.

1864. *Scotophilus georgianus* H. Allen. Monogr. N. Am. Bats, p. 35.

1878. *Vesperugo georgianus* Dobson, Catal. Chiroptera Brit. Mus., p. 235.
1893. *Vesperugo carolinensis* H. Allen, Monogr. Bats N. Am., p. 121 (not *Vespertilio carolinensis* Geoff.).

Type locality.—Eastern United States; probably Georgia.

Geographic distribution.—Austral zones and casually parts of Transition zone in the Eastern United States, from the Atlantic Coast west to Iowa and eastern and southern Texas.

General characters.—Size small (forearm, about 34); thumb long (about $\frac{1}{5}$ forearm); ear when laid forward reaching slightly beyond nostril; tragus straight, tapering to a broadly rounded tip; feet small, slightly more than half as long as tibia; terminal 2 mm. of tail free from membrane; hairs on back mostly distinctly tricolored; general color light yellowish brown, undulated with darker brown.

Ears.—The ears (fig. 20 *a*) are considerably longer than in *P. hesperus*, reaching, when laid forward, just beyond nostril. In general form the ear is much as in *P. hesperus*, but the auricle is slightly narrower, and the basal lobe is smaller and separated from auricle by a slight notch only. On dorsal surface of ear the fur of head extends scarcely to basal third. Otherwise the ear is naked except for a sprinkling of fine hairs on inner surface.

Tragus about half length of ear, broadest opposite anterior base and thence tapering gradually upward to bluntly rounded tip which is turned slightly backward. Anterior border slightly concave at base, then gently convex to tip. Posterior border slightly concave immediately below tip, then strongly convex almost to notch above well developed basal lobe.

Membranes.—The membranes are thin and delicate. Uropatagium thinly furred on basal fourth, otherwise naked except for a few scattered hairs along veins on lower side. Wing membranes attached at base of toes. Uropatagium attached at base of terminal caudal vertebra.

Feet.—Foot large, distinctly more than half as long as tibia, covered with conspicuous light-brown hairs on dorsal surface. Calcar distinctly longer than tibia, scarcely keeled on posterior edge, terminal lobe absent or very indistinct.

Fur and color.—The fur extends on base of ears and interfemoral membrane and on wing membranes to line joining knee and middle of forearm.

Color light yellowish brown, uniform on the ventral surface, but on the back clouded to a varying degree with darker brown. The hairs on the back appear to be of two kinds. The main body of the fur is made up of short hairs (about 6 mm. in length), which are deep plumbeus from base to a little below middle, then yellowish brown almost to extreme tip, which is dark brown. Intermixed with these shorter hairs are others which are much longer (about 10 mm. in length) and clear yellowish brown to extreme tip.

Typical *Pipistrellus subflavus* presents a wide range of individual variation in color. This is due to the extent of the terminal dark bands on the hairs of the back, and also to the exact shade of the yellowish subterminal bands. The yellowest specimens that I have seen were taken at Washington, D. C., during May and June.

Skull.—The skull of *Pipistrellus subflavus* (figs. 21 *a* and 22 *b*) is larger than that of *P. hesperus*. That of an adult male from Washington, D. C., measures 13 mm. in occipito nasal length, 8 mm. in zygomatic breadth, and 5 mm. in occipital depth. The dorsal outline is nearly straight from the anterior nares to a point immediately behind the orbits, then strongly convex to occiput. Muzzle narrow and arched, the concavities on each side nearly obsolete. In general the skull of *Pipistrellus subflavus* suggests a miniature of that of the smaller forms of *Vespertilio*.

FIG. 22.—Side view of skull of (*a*) *Pipistrellus hesperus* and (*b*) *P. subflavus* (×2).

Teeth.—The teeth of *Pipistrellus subflavus* (fig. 23 *b*) are larger than those of *P. hesperus* but essentially similar in form. The anterior upper premolar is large (about the size of the larger upper incisor) and generally fully in the tooth row.

Measurements.—See table, page 957.

Specimens examined.—Total number, 213, from the following localities:

Alabama: Greensboro, 2.
District of Columbia: Washington, 17 (11 skins).
Indian Territory: Stilwell, 13.
Louisiana: Mer Rouge, 10; Houma, 2 (skins).
Maryland: Marshall Hall, 5 (skins); St. Georges Island, 2 (skins).
Mississippi: Washington, 8.
Missouri: Marble Cave, Stone County, 70.
New York: Sing Sing, 33.
North Carolina: Raleigh, 7 (skins); Bertie County, 2 (skins).
Pennsylvania: Carlisle, 7 (1 skin).

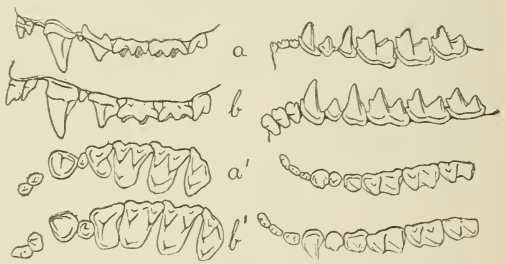

FIG. 23.—Teeth of (*a*) *Pipistrellus hesperus* and (*b*) *P. subflavus* (×5).

Tennessee: Hickman County, 1 (skin); Arlington, 3; Big Sandy, 10; Danville, 4.
Texas: Clear Creek, Galveston County, 1; Brownsville, 1.
Virginia: Cedarville, 6 (skins, Miller coll.); Fredericksburg, 6 (skins); Hampshire County, 1 (skin); Wytheville, 2.

General remarks.—The Georgian bat, *Pipistrellus subflavus*, is so readily distinguished among the species of the region it inhabits that detailed comparisons are scarcely necessary. Its dental formula, small size, relatively large thumb, distinctly tricolored fur and general yellowish color are unmistakable characters.

PIPISTRELLUS SUBFLAVUS OBSCURUS subsp. nov.

Type from Lake George, Warren County, N. Y. Adult ♀ (skin) No. 67723, U. S. National Museum (Biological Survey collection). Collected September 6, 1894, by Walter K. Fisher. Original number, 198.

General characters.—Size and proportions as in typical *subflavus*, but color duller and less yellow, and dark tips of shorter hairs on back more conspicuous.

Ears, membranes, feet, and fur.—As in typical *subflavus*.

Color.—Fur everywhere blackish slate at base. Middle band on shorter hairs of back dull, pale, wood brown or isabella color. Tips of these hairs dusky brown, and much more conspicuous than in true *subflavus*. Long hairs of back pale wood brown. Belly uniform isabella color, in some specimens inclining toward wood brown, but seldom showing any approach to the bright yellowish brown of true *subflavus*.

A melanistic specimen is dark chocolate brown throughout. Two others are rich reddish brown. In all three of these abnormal individuals the characteristic variegation of the fur of the back still persists.

Skull and teeth.—I can find no cranial or dental characters to distinguish *Pipistrellus subflavus obscurus* from the typical subspecies.

Measurements.—See table, page 95.

Specimens examined.—Thirty-four (seven skins), all from the type locality.

General remarks.—*Pipistrellus subflavus obscurus* is readily distinguishable from true *subflavus* by its darker, duller, less yellow color. The difference is especially noticeable on the ventral surface, which is generally a rich yellowish wood brown in typical *subflavus*, dull isabella color in *obscurus*. The darker hue of the back in *obscurus* is due partly to differences in the color of the long hairs, and of the middle bands of the short hairs, and partly to the more extended dark tips of the short hairs. Like the typical form, *Pipistrellus subflavus obscurus* varies considerably in color, so that individual specimens of either subspecies, especially those that are not fully adult, are sometimes difficult to identify. When series are compared, however, the differential characters at once become apparent.

PIPISTRELLUS VERÆCRUCIS (Ward).

1891. *Vesperugo veræcrucis* Ward, Am. Naturalist, XXV, p. 745, August, 1891.

Type locality.—Las Vegas, Jalapa, Vera Cruz.

Geographic distribution.—This species is known from the type locality only.

Characters.—As I have seen no specimens of *Pipistrellus veræcrucis*, I copy the original description.

All six specimens were indistinguishable one from another in point of color. The following color-description is taken from a dried skin, whereas all the rest of the description is taken from a specimen preserved in alcohol.

Hairs of back clove-brown for basal half, followed by two equal zones respectively broccoli-brown and clove-brown; some of hairs furthermore tipped with light Vandyke-brown, giving a decidedly "rusty" tone to the back. Ventral surface; bases of hair slightly lighter than those of back, followed by light-hair brown, producing a grayish or smoky effect.

Wing membranes naked, except a very limited area on upper surface along sides of body, not exceeding 3 or 4 mm. in width; and on lower surface, the area included between a line passing from the middle of humerus to the knee and the side of the body is scantily haired.

Interfemoral membrane with a small, triangular patch of hair on its upper surface, covering base of tail, and extending to one-fourth of its length.

Legs and arms naked. Wing extending from base of outer toe. Antebrachial membrane losing itself at middle of radius. Two caudal vertebræ free from membrane.

Black glandular prominences between eyes and nostrils well developed, fringed with longish hairs on both upper and lower edges, and with three or four long, black, bristly hairs growing from its upper surface.

Inner edge of ear conch evenly convex. Outer edge coming up in an even, sweeping curve from angle of mouth to level of tip of tragus, where it meets a slightly concave line leading up to the obtusely rounded tip. A nearly semi-circular antitragus is developed from that part of the conch passing below the tragus. Bone of inner margin of tragus concave, thus throwing this organ forward, followed by a straight margin. Bone of outer margin with a subtriangular lobe, followed by a deep notch, above which the greatest width is quickly reached. From here a nearly straight line leads to the tip, which is obtusely rounded.

Measurements in millimeters: Length of head and body, from tip of nose to base of tail, 37.5; length of tail, 36; length of tail beyond membrane, 3; length of head, 15; height of ear, from notch between antitragus and conch to tip, 10; height of tragus, inner margin, 4.5; height of tragus, outer margin, 6; greatest width of tragus, 2; length of antitragus, 2; height of antitragus (approximately), .75; length of forearm, 31; length of thumb, including claw and excluding metacarpus, 7.5. Second digit—metacarpal, 29. Third digit—metacarpal, 30.5; first phalanx, 11.5; second phalanx, 11; cartilaginous tip, 5. Fourth digit—metacarpal, 29; first phalanx, 10; second phalanx, 7; cartilaginous tip, 2.5. Fifth digit—metacarpal, 28; first phalanx, 8.5; second phalanx, 5; cartilaginous tip, 1. Interspace between tips of third and fourth digits, 16; interspace between tips of fourth and fifth digits, 37; interspace between tip of fifth digit and juncture of membrane with foot, 42; extent of outstretched wings, 212; length of tibia, 13.5; length of foot, 9; length of calcaneum, about 8.

Teeth, $\frac{2-2}{3-3}, \frac{1-1}{1-1}, \frac{2-2}{2-2}, \frac{3-3}{3-3} = 30$ [34].

Middle upper incisors separated by 1.5 mm., inclined forwards and inwards; a large internal cusp on posterior-external edge halfway up from base to tip. Outer incisors simple, conical, inclined parallel to their respective inner mates, separated from canines by about .75 mm. Lower incisors tri-lobate, evenly spaced. Upper canines long, simple, slightly recurved. Lower canines straight, with basal cusps on forward edge only. First upper premolar interior to tooth line, visible from the exterior. Second upper premolar longer than any of its corresponding molars.

A prominent conical excrescence is on the lower gum, opposite the space between the premolars, in front of which the point of the upper canine passes. Two much less prominent excrescences are on the upper gum immediately above this lower one. Type No. 527 ♂, Las Vegas, V[era Cru]z, February 19, 1891. Collectors, H. L. Ward and C. M. Teran.

General remarks.—*Pipistrellus veracrucis* differs from *P. subflavus* in its smaller size, relatively longer thumb, and browner, less yellow color.

No specimens of this species have been obtained by the field agents of the Biological Survey, nor are any known to be in American museums.

Average measurements of North American forms of Pipistrellus.

Name.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
hesperus	Washington: Almota	1 ♀	77	32	12	6	30	4	52	12.4	9	5.4
	California: Fort Yuma	[1] ♂	70	28	11	5	28	3.8	48	10	8.6	4.6
	Santa Ysabel	10	72.8	32	11.5	5.5	31.6	4	51.4	11.6	8.7	5.2
	Colorado: Grand Junction	4	74.6	31	12	5.5	31.3	4	52	12.1	9.3	5.4
	Texas: Paisano	3	79	34.5	12.8	5.4	32.5	4	55.5	12.4	9.6	5.1
australis	Jalisco: Barranca Ibarra	[1] ♀	64	28	11.4	5	29	4	47	10.4	8.4	5
	Barranca Ibarra	4	63.2	26.8	10.7	5.1	28.6	3.9	45	10.7	8	4.5
veracrucis	Vera Cruz: Las Vegas, Jalapa	[1]	73.5	36	13.5	9	31	7.5	58	....	....	6
subflavus	Louisiana: Mer Rouge	10 ♀ ♀	85.1	40.7	15.3	7.9	34.6	6.8	60.8	14.2	9.8	6.6
	Missouri: Marble Cave	10	84.6	39.8	16.1	8.1	33.7	6.8	60	13.9	9.5	6.4
	District of Columbia: Washington.	5 ♀ ♀	84	37.8	15.2	7.8	34	6.8	62.8	14	9.6	6.6
obscurus	New York: Lake George	10	84.8	38.9	15.2	8	36	6.8	60.6	14	10	6.8

[1] Type; measurements by original describer.

Genus VESPERTILIO Linnæus.

1758. *Vespertilio* Linnæus, Systema Naturæ, 10th ed., I, pp. 31–32. Type by elimination *Vespertilio murinus* Linnæus (not *V. murinus* Schreber, 1775).

1820. *Eptesicus* Rafinesque, Annals of Nature, p. 2. Type *Eptesicus melanops* Rafinesque (=*Vespertilio fuscus* Beauvois).

1829. *Cnephæus* Kaup, Skizzirte. Entw.-Gesch. u. Natürl. Syst. d. Europ. Thierw., I, p. 103. Type *Vespertilio serotinus* Schreber.

1839. *Vesperugo* Keyserling & Blasius, Wiegmann's Archiv f. Naturgesch., 5ter Jahrg., Bd. 1, p. 312 (part).

1839. *Vesperus* Keyserling & Blasius, Wiegmann's Archiv f. Naturgesch., 5ter Jahrg., Bd. 1, p. 313. Based on the 32-toothed species of '*Vesperugo*.'

1841. *Noctula* Bonaparte, Iconografia Fauna Italica, I, fasc. XXI, under *Vespertilio alcythoe*. Type '*Vesperugo*' *serotinus*.

1856. *Cateorus* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 162–163. Type '*Vesperugo*' *serotinus*.

1856. *Meteorus* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 167–169 (included *nilssoni, discolor, savii, leucippe, aristippe*).

1864. *Scotophilus* H. Allen, Monogr. N. Am. Bats, p. 27 (part).

1878. *Vesperugo* Dobson, Catal. Chiroptera Brit. Mus., p. 183 (part).

1892. *Adelonycteris* H. Allen, Proc. Acad. Nat. Sci. Phila. (1891), p. 466, Jan. 19, 1892. (Proposed as a substitute for *Vesperus*, preoccupied in Entomology).

1893. *Adelonycteris* H. Allen, Monogr. Bats, N. Am., p. 111.

Type species.—*Vespertilio murinus* Linnæus (= *V. discolor* Natterer) —not *V. murinus* Schreber.

Geographic distribution.—Boreal, Austral and parts of Tropical regions in both hemispheres.

Generic characters.—Dental formula: $i.\frac{2-2}{3-3}$; $c.\frac{1-1}{1-1}$; $pm.\frac{1-1}{2-2}$; $m.\frac{3-3}{3-3}=32$.

Skull (figs. 24 and 25) large and heavily built; rostrum broad in proportion to brain case (less so than in *Lasionycteris*), scarcely concave at sides back of nasal aperture; dorsal profile nearly straight, rising gradually from external nares to occiput, which in the adult is strongly angular and provided with a conspicuous sagittal crest. Ears short, considerably narrower than long, basal lobe well developed, but not excessively large. Tragus straight, short, directed slightly forward, broadest near the middle and tapering to a moderately sharp point. Back of interfemoral membrane wholly naked except for a sprinkling of hairs on basal fourth. Mammæ, 2.

General remarks.—The genus *Vespertilio* contains the largest American species of the Vespertilionine group. Aside from the dental formula, the large size of *Vespertilio fuscus*, the only known North American species, is sufficient to distinguish the genus among those occurring in the region now under consideration.

The North American species is separable into at least five tolerably well-marked subspecies as follows:

KEY TO THE SUBSPECIES OF VESPERTILIO FUSCUS.

Size small (total length, 96 to 107; forearm, 40 to 45; longest finger, 68 to 77).
  Breadth of muzzle greater than half length of head.....*propinquus* (p. 100)
  Breadth of muzzle less than half length of head.....*bahamensis* (p. 101)
Size large (total length, 105 to 122; forearm, 43 to 52; longest finger, 77 to 96).
  Membranes and ears thick and leathery, the ears distinctly thickened along anterior border.....*fuscus* (p. 96)
  Membranes and ears thin, the ears scarcely thickened along anterior border.
    Forearm, 47 to 50; longest finger, 85 to 89 (average 86).....*cubensis* (p. 102)
    Forearm, 50 to 52; longest finger, 85 to 96 (average 90) ..*miradorensis* (p. 99)

VESPERTILIO FUSCUS Beauvois. Brown Bat.

1796. *Vespertilio fuscus* Beauvois, Catal. Peale's Museum, p. 14. (Philadelphia, Pa.).
1806. *Vespertilio carolinensis* Geoffroy, Ann. Mus. d'Hist. Nat., Paris, VIII, p. 193. (Carolina.)
1818. *Vespertilio phaiops* Rafinesque, Am. Monthly Mag., III, p. 445. (Kentucky.)
1820. *Eptesicus melanops* Rafinesque, Annals of Nature, p. 2. (Kentucky.)
1823. *Vespertilio arquatus* Say, Long's Expedition to Rocky Mountains, I, p. 167, footnote.
1835. *Vespertilio ursinus* Temminck, Monogr. de Mammalogie, II, p. 235.
1843. *Scotophilus greenii* Gray, List Spec. Mamm. Brit. Mus., p. 30 (nomen nudum).
1864. *Scotophilus fuscus* H. Allen, Monogr. N. A. Bats, p. 208.
1878. *Vesperugo serotinus* var. *Vesperus fuscus* Dobson, Catal. Chiroptera Brit. Mus., p. 193.
1893. *Adelonycteris fuscus* H. Allen, Monogr. Bats N. A., p. 112.

Type locality.—Philadelphia, Pa.

Geographic distribution.—Austral, Transition, and (lower edge of) Boreal zones throughout the United States and adjoining British provinces.

General characters.—Size large; total length, 110 to 112; tail vertebræ, 41 to 52; forearm, 43 to 46; longest finger, 77 to 84; ear, 11.6 to 14;

ears and membranes thick and leathery; crowns of upper molars narrow; color variable, but seldom very dark.

Ears.—Ears short, reaching barely to nostril when laid forward, furred on basal third above and sprinkled with hairs on most of inner surface, but especially near anterior border. The membrane of the ear is heavier and more leathery than in the southern subspecies, and the anterior edge is distinctly thickened.

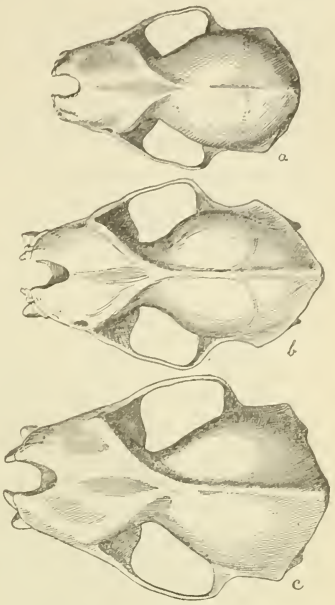

FIG. 24.—Top view of skull of (*a*) *Vespertilio bahamensis*, (*b*) *V. fuscus*, and (*c*) *V. serotinus* (×2).

Membranes.—Membranes naked, broad and ample, that of wings attached to foot a little beyond base of toes. Free edge of interfemoral membrane a little shorter than calcar and terminating at base of penultimate caudal vertebra. The flight membranes, like the ears, are thicker and less membranaceous than in the subpecies occurring in or near the tropics.

Feet.—Foot about half length of tibia; calcar slightly longer than foot, keeled on outer edge, and terminating indistinctly or in a faintly defined lobe. Dorsum of toes with a few short bristle-like hairs.

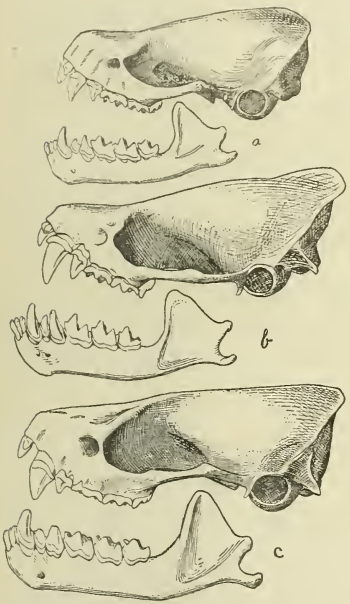

FIG. 25.—Side view of skull of (*a*) *Vespertilio bahamensis*, (*b*) *V. fuscus*, and (*c*) *V. serotinus* (×2).

Fur and color.—On middle of back the fur is about 12 mm. long. The fur extends along the sides in a line about 10 mm. wide on wing membranes both above and below. The proximal third or fourth of uropatagium is furred. Otherwise the membranes are naked except for a few scattered hairs on the under side of the interfemoral membrane and on the under side of the wings close to the humerus and forearm.

Color brown throughout, but always paler on belly than on back. The exact shade varies considerably, but is usually a clear bister or sepia. Sometimes, however, it approaches cinnamon. Ears and membranes blackish in dry specimens.

Skull.—The skull of typical *Vespertilio fuscus* (figs. 24 *b*, 25 *b*) averages

about 18.5 mm. in occipito-nasal length and 12.5 mm. in zygomatic breadth; mandible, 14 mm. It has no tangible characters to distinguish it from the skulls of the other large subspecies.

Teeth.—The teeth of typical *Vespertilio fuscus* (fig. 26 *a*) do not differ appreciably in form or size from those of the other large continental subspecies. They average slightly smaller, however, than in *V. fuscus miradorensis*, and the crown of the middle upper molar is usually narrower.

Measurements.—See table, page 103.

Specimens examined.—Total number, 336, from the following localities:

Alabama: Greensboro, 1.
Arkansas: Fort Towson, 1.
Arizona: Apache, 4; Santa Catalina Mountains, 3 (skins); Chiricahua Mountains, 1 (skin); Guadalupe Cañon, Cochise County, 2 (skins); Fort Verde, 2 (1 skin); Fort Huachuca, 9; Huachuca Mountains, 4 (skins); New River, 2; San Francisco Mountain, 6; Yuma, 1.
British Columbia: Ashcroft, 2 (skins).
California: Bear Valley, San Bernardino County, 2; Cassel, 2; Cloverdale, 1; Dulzura, 3 (1 skin); Horse Corral Meadows, Fresno County (altitude, 8,000 feet), 1; Kern Lakes, North Fork Kern River (altitude, 7,000 feet), 1; Kern River, 6; Kernville, 1; South Fork Kings River, 2; Lone Pine, 7; Little Kern River, 3; Mount Shasta, 2 (skins); Mount Whitney, 2; Nevada City, 6; Nicasio, 63; Owens Lake, 1; Old Fort Tejon, 1; Pine Valley, 4 (skins); Poso Creek, Kern County, 1 (skin); Round Valley, 1; Raymond, 2; Santa Barbara, 2; Sequoia National Park, 9; Sherwood, 1; Twin Oaks, San Diego County, 3; Three Rivers, 1; Tehachapi, 1; Visalia, 2; Walker Basin, Kern County, 4; Yosemite Valley, 2.
Colorado: Loveland, 6 (skins, Miller coll.).
Connecticut: Norfolk, 2.
District of Columbia: Washington, 53 (33 skins).
Georgia: Riceboro, 1.
Idaho: Fort Sherman, 1.
Illinois: Richland County, 1; Warsaw, 4.
Kansas: Fort Riley, 2; Neosho Falls, 1 (skin).
Maine: Eastport, 4.
Massachusetts: Cambridge, 4; Wilmington, 6 (skins).
Mississippi: Bay St. Louis, 2.
Missouri: Marble Cave, Stone County, 5; St. Louis, 1.
Montana: Big Snowy Mountains, 1; Prospect Creek, 2; Kalispell, 2; Milk River, 1.
Nevada: Pyramid Lake, 4; Carson Valley, 1.
New Hampshire: Charlestown, 1.
New York: Hammondville, 6; Sing Sing, 13.
Ontario: Toronto, 1 (skin).
Oregon: Anna Creek, 3; Des Chutes River, 4 (skins); Fort Klamath, 2.
Pennsylvania: Carlisle, 1; Center County, 2 (skins).
South Dakota: Smithville, 5; Custer, 1; Cheyenne River, 1; Fort Pierre, 1; Fort Meade, 1.
Texas: Brazos River, 1.
Utah: Cache County, 1; Laketown, 1; Ogden, 5; St. George, 4.
Washington: Spokane Bridge, 2; Geyser Basin, 1.

General remarks.—In size and general appearance typical *Vespertilio fuscus* occupies a somewhat intermediate position among the North American subspecies. It is considerably smaller than *miradorensis*

and much larger than *propinquus* and *bahamensis*. Very pallid specimens are occasionally taken in the Southwestern United States, but the number of skins available for comparison is so small that it is impossible to determine the status of the form which these aberrant individuals represent.

Vespertilio fuscus and *V. serotinus* have been considered by many writers as races of a circumpolar species. Six specimens of the serotine—four from Budapest, Hungary, and two from Berne, Switzerland—kindly sent me by Mr. Oldfield Thomas, of the British Museum, prove conclusively that this view of the relationship of the two animals is untenable. The differences between the American and European forms are so great that, taken in connection with the complete geographic isolation which undoubtedly exists, they leave no doubt of the necessity of recognizing each as a distinct species. *Vespertilio serotinus* is a large and heavily built animal, approached in size by *V. fuscus miradorensis* alone among the races of *V. fuscus*. The adult females from Budapest measure, respectively: Total length, 131 and 134; tail vertebræ, 52 and 53; tibia, 22.8 and 22.6; foot, 10 and 11; forearm, 52 in each; thumb, 8.4 and 8; longest finger, 93 and 96; ear from meatus, 20 in each; width of ear, 13 and 14; tragus, 9 and 8.6. In addition to its large general size *V. serotinus* has relatively much larger skull and teeth than any of the races of *V. fuscus* (see figs. 24, 25, and 26). The skull of an adult female from Budapest (No. 4489, Miller coll.) measures: Occipito-nasal length, 21.4; zygomatic breadth, 15; mandible, 17; upper tooth row (exclusive of incisors), 8; lower tooth row, 10. The skull is considerably broader in proportion to its length than in *V. fuscus*, and the audital bullæ are relatively smaller. The teeth are much larger than those of *Vespertilio fuscus*, and the inner lobes of the upper molars are broader, in this respect approaching *V. fuscus cubensis*. The upper incisors are separated from the canines by a wider space than in *fuscus*, and this space subtends a distinct groove on the surface of the premaxilla between the roots of the canine and incisors. The paroccipital processes are much more strongly developed in *V. serotinus* than in any of the races of *V. fuscus*.

VESPERTILIO FUSCUS MIRADORENSIS (H. Allen).

1866. *Scotophilus miradorensis* H. Allen, Proc. Acad. Nat. Sci., Phila., p. 287.

Type locality.—Mirador, Vera Cruz, Mexico. Type in the United States National Museum, but now mislaid or lost.

Geographic distribution.—Costa Rica, Guatemala, and southern Mexico. Limits of range not known.

General characters.—Size larger and color darker than in the more northern form. Feet and distribution of fur as in true *fuscus*; ears and membranes thinner and more membranaceous.

Color.—In color *Vespertilio fuscus miradorensis* averages darker than true *fuscus*, thus agreeing with the other southern forms, *propinquus* and *cubensis*.

Skull.—The skull of *Vespertilio fuscus miradorensis* is slightly larger and somewhat less flattened than that of true *fuscus*. The skull of an adult male from Tehuacan, Puebla, measures: Occipito-nasal length, 19.5 mm.; zygomatic breadth, 13; mandible, 14.5. The occiput, although developing even more strongly marked ridges than in the typical subspecies, appears less sharply 'peaked' behind when viewed from the side.

Teeth.—The teeth are heavier than in true *fuscus*, and the crown of the middle upper molar is broader on its inner side, but no tangible dental characters can be established to separate the large subspecies.

Measurements.—See table, page 103.

Specimens examined.—Total number, 17, from the following localities:

Costa Rica: San José, 1.
Guatemala: Zuñil, Quezaltenango, 1.
Mexico: Valley of Toluca, 2 (skins); Ixtapalapa, 2.
Oaxaca: Cerro San Felipe, 1; Oaxaca, 1.
Puebla: Tehuacan, 3 (1 skin).
Tlaxcala: Mt. Malinche, 1.
Vera Cruz: Jico, 1; Las Vigas, 2; Tuxpango, 2 (skins).

VESPERTILIO FUSCUS PROPINQUUS (Peters).

1872. *Vesperus propinquus* Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 262.
1878. *Vesperugo propinquus* Dobson, Catal. Chiroptera Brit. Mus., p. 203.

Type locality.—Santa Ysabel, Guatemala.

Geographic distribution.—In addition to the type the only known specimen of *Vespertilio fuscus propinquus* is from Greytown, Nicaragua.

General characters.—Size very small (total length, 96 to 105; tail vertebrae, 37 to 45; longest finger, 68; ear, 14 to 15); breadth of muzzle distinctly more than half length of head; colors dark.

Ears.—The ears in *Vespertilio fuscus propinquus* are proportionally shorter and broader than in typical *fuscus*, and the tips are distinctly more broadly rounded. They are haired in exactly the same manner as in true *fuscus*. The ear membranes are thin and membranaceous, like those of the other southern races.

Membranes and feet.—Except for their smaller size, the membranes and feet are exactly as in true *fuscus*, though the membranes, like the ears, are thinner and less leathery.

Fur and color.—The fur is shorter than in true *fuscus*, averaging only about 7 mm. on back. There is nothing peculiar in its distribution. In the single alcoholic specimen that I have seen the color is about as in *V. fuscus miradorensis*. Peters, however, describes the color of the type specimen as rust red.[1] This is much brighter than the Greytown specimen, but the color may be due to staining while in alcohol.

Measurements.—See table, page 103.

Specimens examined.—I have seen only one specimen of *Vespertilio fuscus propinquus*. This was collected by Mr. Charles W. Richmond at Greytown, Nicaragua (♀ ad., No. 52790, U. S. National Museum, Dept. of Agriculture collection).

[1] "Oben rostroth, die Haare an der Basis schwarzbraun, Bauchseite blasser, indem die an der Basis schwarzbraunen Haare hier mehr rostgelbe Spitzen haben."

General remarks.—Among the races of *Vespertilio fuscus*, *V. fuscus propinquus* differs most widely in size and in form of head from its nearest geographical ally, *V. fuscus miradorensis*. It combines the small size of the West Indian *bahamensis*, the broad muzzle of true *fuscus*, and the delicate ears and membranes of the southern races in general. Additional material may show that it is specifically distinct.

VESPERTILIO FUSCUS BAHAMENSIS subsp. nov.

Type from Nassau, New Providence, Bahamas. Adult ♂ (in alcohol) No. 76537, U. S. National Museum (Biological Survey collection). Collected in the spring of 1894 by C. J. Maynard.

Geographic distribution.—This form is known from the type locality only.

General characters.—Size about as in *V. fuscus propinquus;* breadth

FIG. 26.—Teeth of (*a*) *Vespertilio fuscus*, (*b*) *V. bahamensis*, (*c*) *V. cubensis*, (*d*) *V. miradorensis*, and (*e*) *V. serotinus* (×5).

of muzzle less than half length of head; ears narrower than in *propinquus*, about as in typical *fuscus*.

Ears.—Ears smaller than in typical *fuscus*, but of essentially the same shape, thus narrower than in *propinquus*. The ear membrane is thinner and more membranaceous than in true *fuscus*, in this respect resembling that of the other southern races.

Membranes and feet.—The membranes and feet are as in typical *fuscus*, allowance being made for the smaller size of *bahamensis*, and the difference in texture of the membranes common to all the southern races.

Fur and color.—The fur is shorter than in true *fuscus*, averaging only about 8 mm. in length on the back. It is distributed exactly as in the typical subspecies. So far as can be determined from specimens preserved in alcohol, the color is considerably darker and duller than in true *fuscus*.

Skull.—The skull of *Vespertilio fuscus bahamensis* is much smaller and more lightly built than that of typical *fuscus* (figs. 24*a* and 25*a*). The skull of a fully adult male measures: Occipito-nasal length, 16.5; zygomatic breadth, 11; mandible, 12.6. In form it differs from that of true *fuscus* in its narrower, deeper, more cylindric brain case and less sharply 'peaked' occiput.

Teeth.—The teeth, like the skull, are smaller than those of true *fuscus* (fig. 26*b*). In a fully adult male the upper tooth row (exclusive of incisors) measures 6.4 mm.; the mandibular tooth row, 7.8 mm. In form the teeth differ slightly from those of true *fuscus* in the greater breadth of the inner (lingual) side of the first and second upper molars.

Measurements.—See table, page 103.

Specimens examined.—Total number 90, all from the type locality.

General remarks.—*Vespertilio fuscus bahamensis* needs no comparison with typical *fuscus* or with *V. fuscus cubensis*, from both of which it differs widely in size. Its superficial resemblance to *V. fuscus propinquus* is closer. Unlike the latter, it has a very narrow muzzle.

VESPERTILIO FUSCUS CUBENSIS (Gray).

1839. *Scotophilus cubensis* Gray, Ann. Nat. Hist., IV, p. 7.
1840. *Vespertilio dutertreus* Gervais, in Ramon de la Sagra's Hist. de l'Ile de Cuba, Mammifères, p. 6.
1892. *Vesperugo fuscus cubensis* Chapman, Bull. Am. Mus. Nat. Hist., IV, p. 316.

Type locality.—Cuba.

Geographic distribution.—Cuba.

General characters.—Externally similar to *Vespertilio fuscus miradorensis*, but slightly smaller in general size, and with much smaller ears. Skull about as large as in true *fuscus*, thus much smaller than in *miradorensis*.

Ears.—The ears are delicate and papery, like those of the other southern races. They are smaller than in either *fuscus* proper or *miradorensis*. In form they differ markedly from those of true *fuscus* in their general narrowness, and especially in their more pointed tips. The characters of the ears have already been described by Mr. Chapman.

Membranes.—In form the membranes do not differ from those of the other subspecies. In texture they agree with the southern forms.

Fur and color.—The fur is distributed exactly as in the other subspecies. In color the specimens, after five years' immersion in alcohol, are darker and redder, especially on the whole ventral surface, than any others that I have seen. They even surpass *V. fuscus miradorensis* in darkness and richness of color.

Skull.—The skull of *Vespertilio fuscus cubensis* is about the size of that of true *fuscus* or a little smaller, thus distinctly smaller than that of *V. fuscus miradorensis*, the form to which *cubensis* bears the closest superficial resemblance, and much larger than that of *bahamensis*, its nearest geographical ally. In form the skull is similar to that of true *fuscus*

but the brain case is slightly less flattened. The sagittal crest is well developed as in the other large subspecies.

Teeth.—The teeth of *Vespertilio fuscus cubensis* (fig. 26 *c*) differ from those of true *fuscus* in the greater breadth of the inner (lingual) sides of the maxillary molars. These teeth are also distinctly shortened in their transverse diameter. These peculiarities are exaggerations of the conditions found in *miradorensis* and *bahamensis*.

Measurements.—See table below.

Specimens examined.—Total number, 11, from the following locality:

Cuba: Trinidad, 10[1]; ———, 1.

General remarks.—*Vespertilio fuscus cubensis* is a fairly well marked insular form apparently most closely related to *V. fuscus miradorensis* of southern Mexico. It differs much less from this large continental subspecies than from *V. fuscus bahamensis*, its nearest geographical ally.

Average measurements of subspecies of Vespertilio fuscus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
fuscus	Massachusetts: Cambridge	2	116	47.5	19.5	10.4	45	6.8	81	18	13.3	8.3
	New York: Sing Sing	10	113.9	44.3	19.1	9.7	45.3	7	80	19.5	12.7	8.3
	District of Columbia: Washington.	5	110.8	46.5	19.1	9.7	44.8	6.5	80.5	18.1	12.8	8
	Mississippi: Bay St. Louis	2	108.5	42	19.5	10	47	6.7	79.5	17.5	12.5	7.8
	California: Nicasio	10	113	47	19.7	9.6	46.4	6	82	17.8	12.7	8.1
	Lone Pine	5	108.6	46	19.6	9.2	44.8	6.1	79.4	17	12.4	8.1
miradorensis	Vera Cruz: Mirador	2[1]	.....	57	....	10.6	50	8.3	....	....	....	8.3
	Jico	1 ♂	118	48	22	10	50	8	91	19.4	13	10
	Las Vigas	1 ♀	120	50	22	10	51	7	85	18	13.6	9
	Tlaxcala: Mt. Malinche	1 ♂	120	50	21.6	11.4	52	6.4	96	19	13	8.8
	Puebla: Tehuacan	2 ♀ ♀	119	50.5	20.7	9.8	50.5	7	90	19	13.3	9
	Guatemala: Zuñil	1 ♂	110	....	20	10.4	50	6.4	....	18.6	12	8
	Costa Rica: San José	1	118	49	22	10	52	6.8	93	20	13.6	9
propinquus	Guatemala: Sta. Ysabel	2[1]	105	45	18	10	40	9.5	....	15	11.4	5
	Nicaragua: Greytown	1 ♀	96	37	17	7.8	40	5	68	14	11	7.8
bahamensis	New Providence: Nassau	2[1] ♂	103	44	18	8	42	6	77	16.8	11	8
	Nassau	10	101.7	42.6	17.9	8.6	42.7	6	74	15.6	11.3	7.6
cubensis	Cuba: Trinidad	10	110.7	48.5	19.9	9	48.4	6.6	86	16.7	12.6	8.4

[1] For the opportunity of examining these specimens I am indebted to Dr. J. A. Allen of the American Museum of Natural History.

[2] Type.

[NOTE.—The following species is not represented in any of the extensive collections of bats recently made in Mexico. As I have never seen the animal and hence can form no opinion as to the weight of its characters, I have not attempted to include it in the synopsis of the North American forms of *Vespertilio*. Dobson's description, based on an examination of the type, may be introduced here, however, as an aid to the recognition of the species.]

VESPERTILIO ALBIGULARIS (Peters).

1872. *Vesperus* (*Marsipolæmus*) *albigularis* Peters, Monatsber. K. Akad. Wiss., Berlin, p. 260.

1878. *Vesperugo albigularis* Dobson, Catal. Chiroptera Brit. Mus., p. 207.

"Ears very broad and broadly rounded off above; the lower half of the outer margin of the ear-conch broadly folded backwards, as in *V. noctula*, separated in front from the angle of the mouth by a wart, *but terminating below and internal to it under the lower jaw by a small internal prolongation:* tragus broad above, attaining its greatest width above the middle of the inner margin, which is slightly concave, narrowest opposite the base of the inner margin, a prominent triangular lobe at the base of the outer margin. Nostrils rather wide apart, opening sublaterally: muzzle broad and obtuse; crown of the head scarcely elevated above the face-line.

"Wings from the base of the toes; postcalcaneal lobe long and narrow; last caudal vertebra free.

"Fur dark brown above, the extreme tips hoary, as in *V. noctivagans*, paler beneath, the *chin and throat*, as far back as a line connecting the posterior margins of the ears, *pure white*.

"Upper inner incisors long and broad and slightly bifid at their extremities; outer incisors very short, shortly exceeding the cingulum of the inner ones in vertical extent; the single upper premolar close to the canine: lower incisors in the direction of the jaws; first lower premolar half the size of the second, which exceeds the molars in vertical extent.

"Length (of the type specimen, an adult ♂), head and body 2″.35 [59.7 mm], tail 1″.5 [38 mm], head 0″.7 [17.8 mm], ear 0″.65 × 0″.13 [16.5 mm × 5.8 mm], forearm 1″.65 [41.9 mm], thumb 0″.35 [8.9 mm], third finger 2″.75 [69.8 mm], fifth finger 2″ [50.8 mm], tibia 0″.6 [15.2 mm], foot 0″.35 [8.9 mm].

"*Hab.*—Mexico. Type in the collection of the Berlin Museum.

"This species may be at once distinguished from all other species of *Vespertilionidæ* by the very peculiar manner in which the outer margin of the ear-conch terminates under the jaw, which has caused the describer, Dr. Peters, to make it the type of a new subgenus, *Marsipolæmus*. In the prolongation of the ear-conch, in the form of the tragus, and in dentition it resembles the African species of *Chalinolobus*."

General remarks.—This species is very different from any of those recently collected in Mexico, and is probably well worthy of subgeneric or even generic separation from *Vespertilio*. Its characters are so remarkable and Mexico has recently been so thoroughly explored that doubt is thrown on the accuracy of Peters' information concerning the type locality.

Genus LASIURUS Gray.

1831. *Lasiurus* Gray, Zoological Miscellany, No. 1, p. 38 (based on the American hairy-tailed bats).
1861. *Lasiurus* H. Allen, Monogr. N. Am. Bats, p. 11.
1870. *Atalapha* Peters, Monatsber. K. Akad. Wiss., Berlin, p. 907. (Not *Atalapha* Rafinesque, 1811.)
1878. *Atalapha* Dobson, Catal. Chiroptera Brit. Mus., p. 267. (Not *Atalapha* Rafinesque, 1814.)
1893. *Atalapha* H. Allen, Monogr. Bats N. Am., p. 141. (Not *Atalapha* Rafinesque, 1814.)

Type species.—*Lasiurus borealis* (Müller).

Geographic distribution of genus.—The whole of North America and South America, the West Indies, Sandwich Islands, and Galapagos Islands.

Generic characters.—Dental formula: $i.\frac{1-1}{3-3}$; $c.\frac{1-1}{1-1}$; $pm.\frac{2-2}{2-2}$; $m.\frac{3-3}{3-3}=32$; upper incisor in contact with canine; a minute upper premolar at base of canine on inner (lingual) side; dental formula otherwise as in *Dasypterus*, *Nycticeius*, and *Rhogeëssa;* skull (figs. 28, 29, 31) broad, short and deep, very different in form from that of any other North American genus of *Vespertilionidæ* except *Dasypterus;* ear (fig. 27) broad, blunt, and rounded at tip, hairy on most of dorsal surface; dorsal surface of interfemoral membrane furred nearly to extreme edge; mammæ, 4.

The members of the genus *Lasiurus* are recognizable among North American bats by their thickly furred interfemoral membranes. Two distinct species are known to occur north of Panama; one of these is divisible into at least five well-marked geographic races.

KEY TO NORTH AMERICAN FORMS OF LASIURUS.

Size large (forearm more than 50 mm.) ..... *cinereus* (p. 112)
Size small (forearm 36–44).
  Underside of wing membrane very sparsely haired along forearm. *mexicanus* (p. 111)
  Underside of wing membrane thickly furred immediately back of forearm.
    Ear small and with slightly developed external basal lobe .... *teliotis* (p. 110)
    Ear large and with well-developed external basal lobe.
      Color mahogany brown ..... *seminolus* (p. 109)
      Color varying from deep rich cherry red through orange and yellow to light yellowish gray.
        Color deep rich cherry red, forearm 42–44 ..... *pfeifferi* (p. 110)
        Color varying from yellowish gray to light red, forearm 36–43 ..... *borealis* (p. 105)

LASIURUS BOREALIS (Müller). Red Bat.

1776. *Vespertilio borealis* Müller, Natursyst. Suppl., p. 21.
1777. *Vespertilio noveboracensis* Erxleben, Syst. Regni Anim., I, p. 155.
1781. *Vespertilio lasiurus* Schreber, Säugthiere, Abth. I, Taf. LXII B (published with Abth. IV Heft 4. See Sherborn, Proc. Zool. Soc. London, 1891, p. 589).
1785. *Vespertilio noveboracus* Boddaert, Elenchus Animalium, I, p. 71.
1785. *Vespertilio lasiurus* Boddaert, Elenchus Animalium, I, p. 71.
1796. *Vespertilio rubellus* Palisot de Beauvois, Catal. Peale's Museum, p. 204.

1814. *Atalapha americana* Rafinesque, Précis des découv. somiol., p. 12 (nomen nudum).[1]
1815. *Vespertilio rubra* Ord, Guthrie's Geography, 2d Am. ed., II, p. 291.
1818. *Vespertilio tesselatus* Rafinesque, American Monthly Mag., III, p. 445.
1818. *Vespertilio monachus* Rafinesque, Am. Monthly Mag., III, p. 445.
1820. *Vespertilio rufus* Warden, Description des États-Unis de l'Amérique Septentrionale, V, p. 606.
1863. *Lasiurus noveboracensis* H. Allen, Monogr. N. Am. Bats, p. 15.
1870. *Lasiurus funebris* Fitzinger, Sitzungsber. k. Akad. Wissensch. Wien, LXII, p. 46.
1878. *Atalapha noveboracensis* Dobson, Catal. Chiroptera Brit. Mus., p. 269.
1893. *Atalapha noveboracensis* H. Allen, Monogr. Bats N. Am., p. 142.
1894. *Atalapha borealis* Rhoads, American Naturalist, XXVIII, p. 523.

Type locality.—New York.

Geographic distribution.—The typical form of *Lasiurus borealis* ranges through the Boreal, Transition, and Austral zones in eastern North America from Canada to Florida and Texas, west at least to Indian Territory and Colorado. Southern and western limits of range not known. Probably breeds throughout its known range.

General characters.—Size small (forearm, 38 to 43; longest finger, 78 to 88); forearm with no distinct tuft of fur near proximal end; color very variable, ranging from bright yellowish red or fawn color to yellowish gray; a whitish area in front of shoulder.

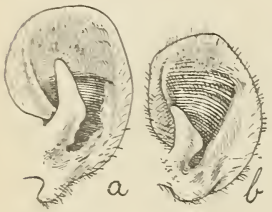

FIG. 27.—Ear of (*a*) *Lasiurus borealis* and (*b*) *L. teliotis* (×2).

Ears.—The ears of typical *Lasiurus borealis* (fig. 27*a*) when laid forward reach a little more than halfway from angle of mouth to nostril. The anterior border is strongly but irregularly convex from free point of anterior basal lobe to tip, a distance through which it forms almost a semicircle. The posterior border is slightly concave immediately below tip, then evenly convex to basal lobe. The convex portion of the outline of the posterior border forms the arc of a circle with considerably longer radius than that of the anterior border. Posterior basal lobe strongly developed and deeply notched on anterior border. Inner side of ear naked except for a few scattered hairs, which are especially numerous along anterior and posterior borders. Outer side densely furred throughout basal two-thirds, naked at tip.

Tragus triangular in general outline. Anterior border straight from base to slight concavity just below tip; posterior border straight from tip to widest point (opposite anterior base), where there is a strong angle, below which the margin is straight to slightly developed basal lobe.

[1] Rafinesque says: "J'ai observe cette espèce [*A. sicula* Raf.] en Sicile, elle diffère de l'*Atalapha americana* (*Vespertilio noveboracensis* Lin.), autre espèce du même genre, par ses deux premiers et son dernier caractère."

Membranes.—The flight membranes are attached at base of toes, the uropatagium at extreme tip of tail.

Feet.—The foot is small, less than half as long as tibia. Dorsal surface of toes thickly furred. Calcar about twice as long as foot and considerably shorter than free border of interfemoral membrane. It is slightly developed, indistinctly keeled, and seldom lobed at tip.

Fur and color.—The fur is everywhere full and soft. On middle of back it is about 7 mm. in length and on neck about 10 mm. It covers the basal two-thirds of dorsal side of ear, the whole dorsal side of the interfemoral membrane, and the dorsal side of the flight membrane to a line running from ankle to middle of humerus. There is a narrow strip of fur running along basal third of fifth metacarpal and a squarish clump at base of thumb. Near base of forearm (in position occupied by strip of fur in *L. cinereus*) there are numerous fine scattered hairs, which are so inconspicuous as readily to escape notice. On the ventral surface the fur reaches about to middle of uropatagium and on flight membranes to line joining knee and elbow. Beyond elbow a sparse growth of hairs covering an area 10 mm. or more in width extends along forearm to bases of fingers, where it becomes much more dense. The antebrachial membrane is covered with a sparse coating of hairs on the ventral surface.

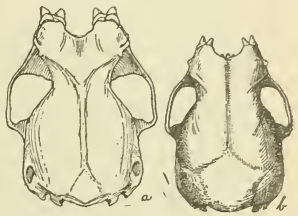

FIG. 28.—Top view of skull of (*a*) *Lasiurus borealis* and (*b*) *L. teliotis* (× 2).

In color typical *Lasiurus borealis* varies very extensively, but never shows the mahogany brown of *seminolus* or the intense red of the tropical races. Red specimens are rufous red throughout (the exact shade somewhere between rufous and burnt sienna), paler and more fawn-colored on the belly, the hairs of the back usually with distinct grayish tips, those on the throat and chest tipped with whitish. A yellowish white patch in front of each shoulder. Frequently the white on chest tends to connect the shoulder patches by a whitish collar. The individual hairs on the back are blackish at base, then light rufous to the narrow subapical band which gives the characteristic color to the back, and, finally, grayish white at extreme tips. Gray specimens are yellowish gray on the back and buffy on the belly. The red usually persists as a faint salmon suffusion.

Skull.—The skull of typical *Lasiurus borealis* (figs. 28 *a*, 29 *b*) has the broad rostrum and flaring zygomata of *L. cinereus*. The dorsal profile of the skull is nearly straight from external nares to highest point of occiput. The skull of an adult female from Washington, D.C., measures: Greatest length, 13.8; zygomatic breadth, 10.2; breadth of rostrum at posterior edge of large premolar, 6; mandible, 10; upper tooth row, 5.4; lower tooth row, 6.4.

Teeth.—The teeth (fig. 30 *b*) are large, the upper molars broad on the

inner (lingual) side, and the lower molars wide in their transverse diameter.

Measurements.—See table, page 115.

Specimens examined.—Total number, 387, from the following localities:

Alabama: Mobile Bay, 3; Greensboro, 9 (2 skins, Merriam coll.).
Arkansas: Fort Smith, 1.
District of Columbia: Washington, 20 (6 skins).
Florida: Old Town, 1 (skin, Miller coll.); St. Marys, 1.
Georgia: Riceboro, 8.
Illinois: Mount Carmel, 1 (skin); Olney, 3; Warsaw, 2; West Northfield, 1 (skin).
Indian Territory: Hartshorne, 1 (skin); Redland, 3.
Kansas: Cedar Vale, 1.
Kentucky: Hickman, 2.
Louisiana: Lafayette, 1; New Orleans, 2; Pineville, 1; Shreveport, 1.
Massachusetts: Nantucket, 1.
Mississippi: Hancock County, 1 (skin, Miller coll.); Washington, 10.
Missouri: Golden City, 1; Marble Cave, Stone County, 1.
New York: Greene, 1; Hartford, 1 (skin); Oyster Bay, 1 (skin); Sing Sing, 86.
North Carolina: Fort Macon, 1 (skin); Magnetic City, 1 (skin); Roan Mountain, 1 (skin).
Oklahoma: Ponca, 2.
Ontario: North Bay, 2 (Miller coll.); Toronto, 1 (skin).
Pennsylvania: Bainbridge, 1; Carlisle, 1 (skin); Kenneth Square, Chester County, 1.
South Carolina: Mount Pleasant (near Charleston), 7 (skins, Miller coll.)
Tamaulipas: Matamoras, 2.
Tennessee: Alexandria, 1; Arlington, 2; Big Sandy, 11; Clarksville, 1; Danville, 1.
Texas: Arthur, 3; Brownsville, 158 (3 skins); Clarksville, 1; Corpus Christi, 2; Fort Clark, 1; Nueces Bay, 1; Paris, 3; Waco, 1 (skin, Miller coll.); Wichita Falls, 1.
Virginia: Amelia Court-House, 1; Berryville, 1 (skin); Dismal Swamp, 2; Gainesville, 1.

General remarks.—Typical *Lasiurus borealis* presents a wide range of individual variation, but may always be distinguished from the other subspecies by fairly constant characters. It never shows the mahogany brown coloring of *L. borealis seminolus* and seldom approaches the brilliant cherry red of *L. borealis pfeifferi*. From *L. borealis teliotis* it differs in its larger ear with well-developed, strongly-notched external basal lobe.

Specimens from Brownsville, Tex., where the animal breeds, are slightly smaller than those from New York, and the ear is proportionally shorter (see table of measurements, p. 115). In this respect they are intermediate between true *borealis* and *teliotis*, though the ear is formed exactly as in the typical subspecies. Specimens from Oklahoma and Indian Territory, on the other hand, are indistinguishable from northeastern specimens.

LASIURUS BOREALIS SEMINOLUS (Rhoads).

1895. *Atalapha borealis seminola* Rhoads, Proc. Acad. Nat. Sci. Phila., p. 32.

Type locality.—Tarpon Springs, Fla.

Geographic distribution.—Lower Austral and Tropical zones from South Carolina to southern Texas.

General characters.—In size and proportions similar to typical *Lasiurus borealis;* general color mahogany brown, slightly frosted with grayish.

Ears, membranes, feet, and distribution of fur.—In all external characters except color *Lasiurus borealis seminolus* agrees with typical *borealis.*

Color.—General color rich mahogany brown throughout, the back (especially between the shoulders) slightly frosted with gray and the throat and chest varied with whitish. A distinct whitish area in front of shoulder as in true *borealis.* Muzzle, backs of ears, and fur bordering forearm, yellowish brown. Clump of fur at base of thumb whitish or yellowish. On middle of back the fur is about 12 mm. in length. In this region the colors on the individual hairs are arranged in four bands as follows: Basal band deep blackish plumbeous (this band usually broader than in true *borealis*), middle band light gray, subapical band rich mahogany, extreme tip grayish white.

Color variation in *Lasiurus borealis seminolus* is much less than in typical *borealis*, and is chiefly noticeable in the amount of red in the mahogany brown, in the amount of white on the throat and chest, and in the shade of gray in the broad middle band on the hairs of the back. This is often strongly suffused with yellowish.

Skull and teeth.—As in typical *borealis.*

Measurements.—See table, page 115.

Specimens examined.—Total number, 19, from the following localities:

Florida: Old Town, 3 (skins, Miller coll.); Lake Harney, 2.
Georgia: Nashville, 1.
Louisiana: New Orleans, 5.
Mississippi: Bay St. Louis, 3.
South Carolina: Mount Pleasant (near Charleston), 4.
Texas: Brownsville, 1.

General remarks.—*Lasiurus borealis seminolus* appears to be a well-marked subspecies confined to the Austroriparian fauna. The single specimen taken at Brownsville, Texas (No. 59976, U. S. National Museum) was killed on September 8, 1891, and may have been a migrant. No intermediates between *seminolus* and true *borealis* has yet come to light, but the perfect agreement of the two forms in all charaters except color makes me unwilling to recognize them as species. The possibility that *seminolus* and true *borealis* are dichromatic phases of one species lacks weight on account of the total absence of intermediate specimens, and also from the fact that both forms have not yet been found breeding at any one locality.

LASIURUS BOREALIS PFEIFFERI (Gundlach).

1861. *Atalapha pfeifferi* Gundlach, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 152.
1878. *Atalapha noveboracensis* var. β (*Atalapha pfeifferi*) Dobson, Catal. Chiroptera Brit. Mus., p. 271.
1892. *Atalapha noveboracensis pfeifferi* Chapman, Bull. Am. Mus. Nat. Hist., IV, p. 316.

Type locality.—Cuba.

Geographic distribution.—Cuba. Jamaica? Bahamas?

General characters.—Slightly larger than typical *Lasiurus borealis*, but similar in proportions; color brighter and more intense.

Ears, membranes, feet, and distribution of fur.—As in the typical subspecies.

Color.—I have seen no skins of the Cuban red bat, and am therefore unable to give a detailed description of the animal's color. The two specimens collected by Mr. Chapman in 1892 have now been in alcohol for five years. Hence their color furnishes no trustworthy basis for comparison with that of continental material. When compared with alcoholic specimens from the eastern United States they are appreciably brighter.

Measurements.—See table, page 115.

Specimens examined.—Two from Trinidad, Cuba (Am. Mus. Nat. Hist.).

A skull from Nassau, Bahamas (Miller coll.), and an imperfect skin from Spanishtown, Jamaica, may be referable to this race, but it is not possible to identify them with certainty.

General remarks.—*Lasiurus borealis pfeifferi* is a tolerably well-marked insular form, distinguished from typical *borealis* by its slightly larger size and brighter color.

LASIURUS BOREALIS TELIOTIS (H. Allen).

1891. *Atalapha teliotis* H. Allen, Proc. Am. Philos. Soc., XXIX, p. 1.
1893. *Atalapha teliotis* H. Allen, Monogr. Bats N. Am., p. 153.

Type locality.—Unknown, probably some part of California (type in U. S. National Museum).

Geographic distribution.—This form is known from a few localities in California and Lower California from the head of the Sacramento Valley south to Comondu.

General characters.—Slightly smaller than typical *Lasiurus borealis;* ear proportionally much shorter than in the typical subspecies, and with external basal lobe greatly reduced in size; color averaging brighter than in the typical form.

Ears.—The ear (fig. 27*b*) is similar in form to that of typical *borealis*, except that the tip is slightly narrower and the external basal lobe is reduced in size, indistinctly marked off from the rest of the ear, and scarcely, if at all, notched on its anterior border.

Membranes, feet, and distribution of fur.—The external form, with the exception of the size and shape of ears, is as in true *borealis.*

Color.—I have seen only four skins of the Californian red bat. In

these the color is uniformly slightly darker and redder than in ordinary red specimens of true *borealis*. The difference is especially noticeable on the interfemoral membrane, rump, and lumbar region. One skin (♂) from Dulzura, Cal., almost lacks the grayish tips to the hairs on the back. Another (also ♂) taken at the same place on the same day (November 5, 1891) shows the gray tips very distinctly on the neck and fore part of the back.

Skull.—The skull of *Lasiurus borealis teliotis* (figs. 28*b*, 29*a*) is distinguishable from that of typical *borealis* by its smaller size, narrower rostrum, and less flaring zygomata. That of an adult male from Dulzura, Cal., measures: Greatest length, 12.4; zygomatic breadth, 9; breadth of rostrum at posterior edge of large premolar, 5.2; upper tooth row, 4.6. The mandible of this specimen is lost. That of another adult male from the same locality measures: Length, 9; lower tooth row, 5.4.

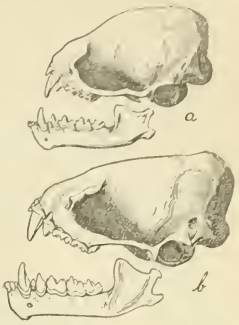

FIG. 29.—Side view of skull of (*a*) *Lasiurus teliotis* and (*b*) *L. borealis* (×2).

Teeth.—The teeth are smaller than in the typical subspecies, the upper molars are narrower on the inner (lingual) side, and the mandibular teeth are narrower in their transverse diameter (fig. 30*a*.)

Measurements.—See table, page 115.

Specimens examined.—Total number, 10, from the following localities:

California: Exact locality unknown, 1 (type); Bakersfield, 1; Berryessa, Santa Clara County, 1 (skin); Dulzura, 2 (skins, Miller coll.); Fresno, 1; Santa Ysabel, San Diego County, 1; Tehama, 1; Three Rivers, 1.
Lower California: Comondu, 1 (skin).

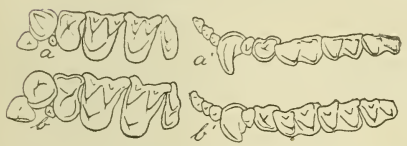

FIG. 30.—Teeth of (*a*) *Lasiurus teliotis* and (*b*) *L. borealis* (×5).

General remarks.—*Lasiurus borealis teliotis* is readily distinguishable from typical *borealis* by its smaller ear, with less developed and entire external basal lobe, smaller skull, with narrower rostrum, and weaker dentition. From *L. borealis mexicanus* it differs in completely furred dorsum of interfemoral membrane and more hairy under side of wing.

LASIURUS BOREALIS MEXICANUS (Saussure).

1861. *Atalapha mexicana* Saussure, Revue et Mag. de Zool., 2e sér., XIII, p. 97, Mars., 1861 (southern Mexico).

1871. *Atalapha frantzii* Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin (1870), p. 908, 1871 (Costa Rica).

1878. *Atalapha noveboracensis* var. α (*Atalapha frantzii*) Dobson, Catal. Chiroptera Brit. Mus., p. 271.

Type locality.—Not stated, but without doubt in some one of the States of southern Mexico, probably Vera Cruz, Puebla, or Oaxaca.

Geographic distribution.—Central America and southern Mexico. Limits of range unknown.

General characters.—Apparently most like *Lasiurus borealis teliotis*, but feet, interfemoral membrane, and under side of wings much less hairy.

Ears.—In dried specimens the ears appear to be essentially as in *L. borealis teliotis*, though the external basal lobe may be slightly more developed.

Membranes and feet.—These show no distinctive characters.

Fur and color.—On the body the fur shows no peculiarities as compared with the other subspecies. On the interfemoral membrane it extends thickly to about the middle, then becomes more sparse, and finally disappears, leaving the edge of the membrane bare. The backs of the feet are scarcely furred. On the under side of the wings, the area behind the forearm which is densely furred in the other subspecies, is merely sprinkled with inconspicuous hairs; these are, however, more dense at the bases of the fingers. The antebrachial membrane is also very sparsely furred.

Color as in *L. borealis teliotis*.

Measurements.—See table, page 115.

Specimens examined.—Total number, 8, from the following localities:

Jalisco: ——, 6.
Tehuantepec: Guichicovi, 1 (skin).
Vera Cruz: Penuela (near Cordova), 1 (skin).

General remarks.—From the unsatisfactory material at my disposal it appears that *Lasiurus borealis mexicanus* is a well-marked race, most like *teliotis*, but differing from this, as well as from all the other known subspecies, in the restricted peripheral distribution of the fur.

LASIURUS CINEREUS (Beauvois). Hoary bat.

1796. *Vespertilio lineretis* Palisot de Beauvois, Catal. Peale's Museum, Philadelphia, p. 14. (Obvious misprint for *cinereus*.)
1823. *Vespertilio pruinosus* Say, Long's Exped. to Rocky Mts., I, p. 167 (footnote).
1864. *Lasiurus cinereus* H. Allen, Monogr. N. Am. Bats, p. 21.
1878. *Atalapha cinerea* Dobson, Catal. Chiroptera Brit. Mus., p. 272.
1893. *Atalapha cinerea* H. Allen, Monogr. Bats N. Am., p. 155.

Type locality.—Philadelphia, Pennsylvania.

Geographic distribution.—Boreal North America from Atlantic to Pacific. The hoary bat breeds within the Boreal zone, but in autumn and winter it migrates south to the southern border of the United States and probably much farther.

General characters.—Size, large (forearm, over 50 mm.); prevailing color, gray; ears with black rims; forearm with distinct patch of fur near base.

Ears.—The ears of *Lasiurus cinereus* are in general similar to those of *L. borealis*, but are broader in proportion to their length (see table of measurements, p. 115). The external basal lobe is less developed than

in *borealis* and without trace of notch on anterior border. Margin of ear membrane dark brown or blackish. Outer side of ear densely furred to a little beyond middle. Inner side with conspicuous patch of yellowish hairs above and in front of middle and a border of similar hairs along lower part of anterior edge.

Tragus shaped as in *L. borealis*, covered with sparse coating of hairs on outer side.

Membranes.—In form and attachment the membranes are as in *L. borealis.*

Feet.—Foot about half as long as tibia; dorsal side thickly furred. Calcar twice as long as foot and slightly shorter than free border of interfemoral membrane. It is distinctly though narrowly keeled on posterior edge, and usually lobed at tip. The terminal lobe is very variable, and may be well developed on one side and absent on the other.

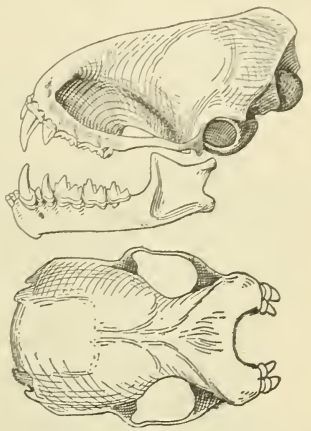

FIG. 31.—Skull of *Lasiurus cinereus* (×2).

Fur and color.—The fur is distributed much as in *L. borealis.* As in that species, it is distinctly longer on neck than on back, thus forming a ruff. On the neck it averages about 15 mm. in length, on the back 11 mm. General color, a mixture of light yellowish brown, deep umber brown, and white, the yellowish brown clear and unmixed on throat, head, and under side of membranes, the umber brown predominating on back and dorsal surface of interfemoral membrane, where, however, the hairs are mostly tipped with silvery white, sometimes to so great an extent as nearly to conceal the dark tints beneath. Lips, chin, and cheeks sprinkled with short blackish hairs. Ventral surface with white predominating on belly, between which and yellow of throat is a band in which the umber brown is more conspicuous than elsewhere on the under parts. Tufts of fur at bases of thumb, fifth finger, and forearm, light yellowish brown, like fur on under side of wing membranes. On middle of back the individual hairs are colored as follows: Deep plumbeous at base; light yellowish brown (shading toward umber distally) through middle half; umber brown subapically; silvery white at tip.

Color variation is considerable, but never enough to obscure the characters of the species. It appears to be wholly independent of locality, as skins from such widely separated localities as Minnesota and southern California are practically indistinguishable.

One skin from the Santee River, South Carolina, has the dusky tints throughout the pelage so intensified and extended as to suggest melan-

ism. Another from Eureka, California, is in a similar phase, though not so extreme.

Skull.—The skull (fig. 31) resembles that of *Dasypterus intermedius* and *Lasiurus borealis*, but is intermediate between the two in size. The rostrum is broad and short and the zygomatic arches broadly flaring. The skull of an adult female from Santa Ysabel, California, measures: Greatest length, 16.4; zygomatic breadth, 12; breadth of rostrum at posterior border of large premolar, 8; mandible, 12.6; upper-tooth row, 6.4; lower-tooth row, 8. That of an adult female from Fort Snelling, Minnesota, measures: Greatest length, 17; zygomatic breadth, 12; breadth of rostrum at posterior edge of large premolar, 8; mandible, 13.6; upper-tooth row, 7; lower-tooth row, 8.

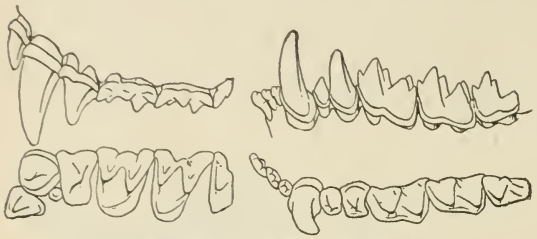

FIG. 32.—Teeth of *Lasiurus cinereus* (×5).

Teeth.—The teeth of *Lasiurus cinereus* (fig. 32) are large and strong, but the minute upper premolar is proportionally smaller than in *L. borealis*.

Measurements.—See table, page 115.

Specimens examined.—Total number, 56, from the following localities:

Alabama: Mobile Bay, 1.
Alberta: Eight miles NW. of Red Deer, 1 (skin, Miller coll.).
Arizona: Tempe, Maricopa County, 1.
California: Berryessa, Santa Clara County, 1; Cloverdale, 1; Eureka, 1 (skin); Kern River, 1; Monterey, 1; Nicasio, 1; Panamint Mountains, 2; Santa Ysabel, 1 (skin).
Chihuahua: San Luis Mountains, 1.
Colorado: Larimer County, 3 (skins, Miller coll.).
District of Columbia: Washington, 1.
Georgia: Savannah River, 1.
Illinois: Warsaw, 1.
Kansas: Little Blue River, 1; North Falls, 1.
Louisiana: Pineville, 1.
Maryland: Laurel, 1.
Massachusetts: North Truro, 6 (skins, Miller coll.).
Minnesota: Fort Snelling, 1.
Nebraska: Fort Pierre, 1; Fort Union, 2; Loup Fork, 1.
Nevada: Vegas Valley, 1.
New Mexico: Dog Spring, Grant County, 2; Doña Ana, 1.
New York: Westville, Long Island, 1; Locust Grove, 4.
Nova Scotia: Halifax, 1.
Tamaulipas: Matamoras, 1.
Texas: Brownsville, 9 (1 skin, Miller coll.).
Washington: Almota, 1; Fort Walla Walla, 1.

Average measurements of North American forms of Lasiurus.

Name.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
borealis	Ontario: North Bay	2 ♂ ♂	106	47.5	19.5	7.2	39	6.7	79.5	11.8	11.4	6.5
	New York: Sing Sing	10	110.4	50.9	19.6	7.8	39.7	7	81.7	11.9	11	7
	District of Columbia: Washington.	4	103	47.5	19.2	7.4	38.5	6.3	79.3	11.2	10.1	6.5
	Mississippi: Washington.	10	105.6	49.1	19.2	7.4	40.1	7.3	80.4	11.8	10.1	6.7
	Texas: Brownsville	10	108.9	52.7	18.6	7.9	40.6	6.4	82.8	10.5	9.8	6.1
seminolus	South Carolina: Charleston.	2 ♂ ♂	100	46	19	6.9	40	7	81	12.7	10.7	6.9
	Florida: Lake Harney	2 ♂ ♂	97.5	45	19.3	7	40	7	79	11.3	10	6.5
	Mississippi: Bay St. Louis	3 ♀ ♀	104.3	50	19.3	7.6	40.2	7.4	83	12	11	6.5
	Texas: Brownsville	1 ♀	115	54	20	9	42	7	87	12.6	11.4	7
pfeifferi	Cuba: Trinidad	2 ♂ ♂	106.5	50.5	21.8	7	44	6.8	89.5	12.5	10.7	6.8
teliotis	California: ? (type)	1	.....	....	20	6.6	39	7	79	9	7.6	5.4
	Three Rivers	1 ♂	96	47	....	8	37	6.6	74	9.8	9.8	6.4
	Tehama	1 ♂	107	57	20	8	39	6.4	82	9.4	9.6	6
	Bakersfield	1 ♀	100	45	19.6	8.6	40	7	76	10	9	6
mexicanus	Jalisco	6	113.3	57	20.2	8.1	41.2	7.4	86.5	13	10.2	6.5
cinereus	New York: Locust Grove.	4	134.5	57.5	23.2	10	50.2	10.6	107	18	17.2	9.5
	California: Panamint Mts.	2 ♀ ♀	136	58.5	23.5	9	54	10	109	17.5	17.7	9
	Cloverdale	1 ♂	130	52	23	10	46	10.4	101	17	15	9
	Monterey	1 ♂	138	57	24	9	55	10	110	17	16	9
	Kern River	1 ♂	140	58	23	9	51	10	103	18	17.6	9

Genus DASYPTERUS Peters.

1864. *Lasiurus* H. Allen, Monogr. N. Am. Bats, p. 25 (part).
1871. *Dasypterus* Peters, Monatsber. K. Akad. Wiss., Berlin (1870), p. 912 (subgenus).
1878. *Atalapha* Dobson, Catal. Chiroptera Brit. Mus., p. 267. (Part—not *Atalapha* Rafinesque, 1814.)
1893. *Dasypterus* H. Allen, Monogr. Bats N. Am., p. 137 (genus).

Type species.—*Dasypterus intermedius* H. Allen.

Geographic distribution of type species.—Gulf States and northeastern Mexico.

Geographic distribution of genus.—The range of the genus is the same as that of the only known species.

Generic characters.—Dental formula:

$$i, \frac{1-1}{3-3}; \; c, \frac{1-1}{1-1}; \; pm, \frac{1-1}{2-2}; \; m, \frac{3-3}{3-3} = 30;$$

upper incisor in contact with canine; skull (fig. 33) easily distinguishable from that of any other American genus of *Vespertilionidæ*, except *Lasiurus*, by its extreme shortness, depth, and breadth; ear considerably higher than broad, somewhat tapering at tip, naked on half of dorsal surface; dorsal surface of interfemoral membrane furred on basal half only; mammæ, 4.

General remarks.—Without seeing the South American species originally associated with *D. intermedius* by Peters, it is impossible to determine whether these belong in the genus as now understood.

DASYPTERUS INTERMEDIUS H. Allen.

1863. *Lasiurus intermedius* H. Allen. Proc. Acad. Nat. Sci. Phila. (1862), p. 146.
1864. *Lasiurus intermedius* H. Allen. Monogr. N. A. Bats, p. 25.
1878. *Atalapha intermedia* Dobson, Catal. Chiroptera Brit. Mus., p. 274.
1893. *Dasypterus intermedius* H. Allen, Monogr. Bats N. Am., p. 137.

Type locality.—Matamoras, Tamaulipas, Mexico.

Geographic distribution.—Gulf States and northeastern Mexico.

General characters.—Size, large (forearm, 45–56); color, light brown.

Ears.—The ears are short, reaching barely to nostril when laid forward. The dorsal surface is densely furred on basal half, but otherwise the ear is naked except for a sprinkling of hairs on inner side, especially along anterior edge. Beginning at lower edge of basal lobe the anterior margin is first strongly convex, then nearly straight for a distance of about 6 mm., then abruptly convex (or even angular), after which it continues nearly straight to narrowly rounded off tip. Posterior border slightly concave immediately below tip, then gently and evenly convex to notch above posterior basal lobe. Posterior basal lobe well developed, slightly notched on lower side, and joining face about 5 mm. behind angle of mouth.

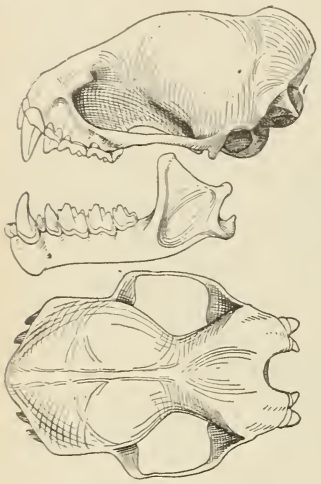

FIG. 33.—Skull of *Dasypterus intermedius* (×2.)

Tragus blunt and bent forward, anterior border nearly straight to slight concavity just below tip. Posterior border convex immediately below tip, then straight to point opposite anterior base. Here a sharp angle is formed, below which the margin is irregularly crenulated to base.

Feet.—The foot is moderate in size, a little less than half as long as tibia. Calcar slightly shorter than tibia, very indistinctly keeled and terminating obscurely or in an ill-defined lobe.

Membranes.—Membranes thick and leathery. Wing membrane attached at base of toes, uropatagium near tip of last caudal vertebra. Free border of uropatagium slightly longer than calcar.

Fur and color.—The fur is full and soft. On the middle of the back it is about 12 mm. in length. The fur of the back extends on basal half of outer side of ear, basal half of dorsal surface of interfemoral membrane, and base of wing membranes. On the latter it occupies a strip about 10 mm. in width. There is a slight tuft of hair at the base of the

thumb, and in many specimens a faintly indicated tuft near proximal end of forearm. On the ventral surface the fur barely reaches the uropatagium except along the basal fourth of tail. A thin coating of fur occupies the under side of the wing membrane to a line joining elbow and knee. Beyond this it extends in a strip about 10 mm. wide along posterior edge of forearm to bases of fingers. The greater part of the propatagium is thinly furred.

Color light yellowish brown of variable shade, the hairs throughout the body with narrow dark plumbeous bases and those of the back with faintly dusky tips. The general effect is suggestive of the color of *Pipistrellus subflavus*.

Skull and teeth.—The skull (fig. 33) and teeth (fig. 34) have been sufficiently described under generic characters. The skull of an adult

FIG. 34.—Teeth of *Dasypterus intermedius* (×5).

female from Brownsville, Tex. (No. 52540, U. S. National Museum), measures: Greatest length, 19.6; zygomatic breadth, 15; breadth of rostrum at posterior edge of premolar, 9; mandible, 15; upper tooth row, 8; lower tooth row, 9. The skull of an adult male from Houma, La., measures: Greatest length, 18; zygomatic breadth, 13; breadth of rostrum at posterior edge of premolar, 8; mandible, 14; upper tooth row, 7; lower tooth row, 8.6.

Measurements.—Average measurements of 18 specimens of *Dasypterus intermedius* from five localities are given in the following table:

Average measurements of 18 specimens of Dasypterus intermedius from 5 localities.

Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
Texas: Brownsville	10 ♀ ♀	145	65.9	24.9	10	55	8.9	111	18.8	14.4	8.8
Louisiana: Lafayette	2 ♀ ♀	126.5	52	20	8.7	48	7	96	18.5	15.5	9.3
Houma	2 ♂ ♂	130	61	18.9	9	46	6	95.5	18	15	9.4
Florida: Old Town	3	127	63.5	20	9	45.5	.....	.....	.....	.....	.....
Mullet Lake	1 ♂	120	54	18	8	47	7	95	17	14	8

Specimens examined.—Total number 72, from the following localities:

Florida: Davenport, 1 (skin); Mullet Lake, 1; Old Town, 3.
Louisiana: Lafayette, 2; Houma, 2 (1 skin).
Mississippi: Hancock County, 1 (skin).
Tamaulipas: Matamoras, 3 (2 skeletons).
Texas: Brownsville, 57 (2 skins); Padre Island, 1; Cameron County, 1.

General remarks.—Aside from its generic characters *Dasypterus intermedius* is distinguishable among North American bats by its large size, small ears, and yellowish brown color.

Specimens from Louisiana, Mississippi, and Florida average distinctly smaller than those from Brownsville, Tex. (which are essentially topotypes). More extensive material than that now available may show the necessity of recognizing two subspecies, a larger Tamaulipan (typical) form, and a smaller Austroriparian form.

Genus NYCTICEIUS Rafinesque.

1819. *Nycticeius* Rafinesque, Journ. de Physique, LXXXVIII, June, 1819, p. 417.
1827. *Nycticeus* Lesson, Man. de Mamm., p. 98.
1827. *Nycticejus* Temminck, Monographies de Mamm., I, p. xviii.
1830. *Nycticeyx* Wagler, Natürl. System der Amphibien, p. 13.
1831. *Nycticea* Le Conte, McMurtrie's Cuvier, Animal Kingdom, p. 432.
1864. *Nycticejus* H. Allen, Monogr. N. Am. Bats, p. 11.
1878. *Nycticejus* Dobson, Catal. Chiroptera Brit. Mus., p. 266.
1893. *Nycticejus* H. Allen, Monogr. Bats N. Am., p. 131.

Type species.—*Nycticeius humeralis* Rafinesque.

Geographic distribution of type species.—Austral zones in the Eastern United States.

Geographic distribution of genus.—Austral zones in the Eastern United States. Cuba.

Generic characters.—Dental formula:

$$i, \frac{1-1}{3-3}; \ c, \frac{1-1}{1-1}; \ pm, \frac{1-1}{2-2}; \ m, \frac{3-3}{3-3} = 30;$$

upper incisor distinctly separated from canine; lower incisors scarcely crowded; outer lower incisor tricuspidate and not smaller than others; skull low and narrow; uropatagium furred at extreme base only; tragus blunt and bent forward; tip of tail free from membrane; mammæ, 2.

The genus *Nycticeius* as thus defined is peculiar to America, where it is represented by one species. It differs in dental formula from all other genera of American *Vespertilionidæ* except *Dasypterus* and *Rhogeëssa*. From the former it is distinguishable by its differently shaped skull, wide space between upper incisor and canine, and essentially naked uropatagium. From *Rhogeëssa* it is separated by details in the structure of teeth and skull, as well as by external characters.

NYCTICEIUS HUMERALIS Rafinesque. Rafinesque's Bat.

1818. *Vespertilio humeralis* Rafinesque, American Monthly Mag., III, p. 445.
1819. *Nycticeius humeralis* Rafinesque, Journ. de Physique, LXXXVIII, p. 417.
1831. *Nycticea crepuscularis* Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 432.

1861. *Nycticejus crepuscularis* H. Allen, Monogr. N. Am. Bats, p. 11.
1878. *Nycticejus crepuscularis* Dobson, Catal. Chiroptera Brit. Mus., p. 266.
1891. *Nycticejus humeralis* Thomas, Ann. & Mag. Nat. Hist., 6th ser., VII, p. 528.
1893. *Nycticejus humeralis* H. Allen, Monogr. Bats, N. Am., p. 132.

Type locality.—Kentucky.

Geographic distribution.—Austral zones in the eastern United States west to Arkansas and southern Texas.

General characters.—Size, medium (total length, 88 to 95; forearm, 34 to 38); color, dull brownish, slightly paler beneath.

Ears.—The ears are small and for their size remarkably thick and leathery. They are naked throughout except at extreme base above. Lower anterior half of inner surface with a few short scattered hairs. Anterior border strongly convex immediately above small but distinct anterior basal lobe, then very slightly convex to narrowly rounded off tip. Posterior border gently concave from immediately below tip to a little below middle, then convex to slightly developed external basal lobe.

Tragus short, broad, and blunt, bent slightly forward; posterior base with distinct lobule.

Membranes.—The membranes, like the ears, are thick and leathery. Wing membranes attached at base of toes, uropatagium at middle of terminal caudal vertebra.

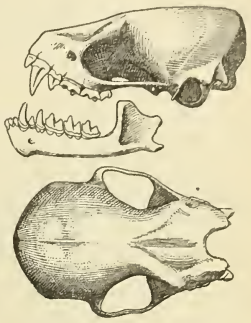

FIG. 35.—Skull of *Nycticeius humeralis* (×2).

Fur and color.—The fur is sparse and short, that on middle of back averaging about 6 mm. in length. It is closely confined to the body, barely reaching extreme base of uropatagium and flight membranes.

Color dull umber brown above, paler below, the fur everywhere plumbeous at extreme base, but the dark basal color less well defined than in other species with which *Nycticeius* is found associated. The exact shade varies slightly, but is usually burnt umber or mummy brown on the back and raw umber or hair brown on the belly. One skin from Hickman County, Tenn. (No. 30637, U. S. National Museum), is dark sepia above, broccoli brown below.

Skull.—The skull (fig. 35) is short, broad, and low. That of an adult female from Sans Souci, N. C. (No. 43037, U. S. National Museum), measures 14 mm. in greatest length and 10 mm. in zygomatic breadth; greatest length of mandible, 10.6. Dorsal profile nearly straight from external nares to occiput, but slightly convex over front part of brain case. Occiput never developing strongly marked ridges. Length of bony palate behind molars (exclusive of central spine), about half width of interpterygoid fossa.

Teeth.—The teeth (fig. 36) are not so large as might be expected from the massiveness of the skull. Upper tooth row of adult female from Sans Souci, N. C., 6; lower, 6.8. Upper incisor close to canine, but

separated from it by a space less than half as great as the diameter of the incisor. Upper molars much narrower on the inner side than on the outer side. Outer lower incisor with transverse diameter of crown slightly greater than that of second or third.

FIG. 36.—Teeth of *Nycticeius humeralis* (×5).

Measurements.—In the following table average measurements are given of 35 specimens of *Nycticeius humeralis* from the United States, and for comparison, Gundlach's measurements of a dry specimen of *N. humeralis cubanus.*

Average measurements of 36 specimens of Nycticeius.

Name.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
humeralis	Pennsylvania: Carlisle	10	93.5	36.9	13.8	6.7	36.2	5.4	64.5	13.9	10	6.1
	Virginia: Dismal Swamp	5	91.4	35.8	13.4	7.7	35.8	5.6	63.4	13.5	10.5	6.2
	Tennessee: Big Sandy	10	92.2	36.3	13.7	7.3	34.3	5.5	63.4	13.1	9.9	5.9
	Texas: Brownsville	10	92.3	37.2	13.6	7.2	36.4	5.3	65.2	12.7	8.8	5.1
cubanus	Cuba	1	....	29	11	6.7	30	5.5	55	....	....	....

Specimens examined.—Total number 154, from the following localities:

Arkansas: Fort Smith, 5.
District of Columbia: Washington, 2.
Florida: Titusville, 1; Chattahoochee, 1.
Georgia: Riceboro, 3.
Indian Territory: Redland, 4.
Kentucky: Hickman, 7.
Louisiana: Mer Rouge, 19; Pineville, 1.
Mississippi: Bay St. Louis, 17; Washington, 2.
North Carolina: Bertie County, 9; Sans Souci, 4 (skins).
Pennsylvania: Carlisle, 12.
Tamaulipas: Matamoras, 1.
Tennessee: Big Sandy, 13; Danville, 2; Warner, 1; Arlington, 4; Hickman County, 1 (skin).
Texas: Brownsville, 32; Paris, 3; Arthur, 1; Lomita Ranch, 2; Hidalgo, 1.
Virginia: Dismal Swamp, 5; near Riverton, 1 (skin, Miller coll.).

NYCTICEIUS HUMERALIS CUBANUS (Gundlach).

1861. *Vesperus cubanus* Gundlach, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 150.
1877. *Nycticeius cubanus*, Gundlach, Contribucion á la Mamalogia Cubana, p. 33.

Type locality.—Cuba.
Geographic distribution.—Cuba.

Characters.—I have not seen specimens of *Nycticeius* from Cuba, but Gundlach's careful description of the animal leaves no doubt that it is distinct from the form occurring on the mainland. It is distinguished from the latter by smaller size and apparently also by paler color. A translation of Gundlach's second and more perfect account of the animal is as follows: "Pelage above light tawny (the fur blackish at base), beneath pale reddish tawny (the base of the fur likewise blackish). Face and flight membranes blackish brown. The nose appears somewhat divided by the projecting nostrils; between the nose and the eyes there is on each side a protuberance with bristly hairs. Ears oval, lengthened (8 mm. high in front). The anterior base rounded and spreading outward; the posterior at the angle of the mouth forms a semicircle. This semicircle, which bends inward to the tragus, forms another rounded enlargement. Tragus oblong, scarcely narrowed throughout, somewhat bent in the form of a sickle forward and provided with a tooth-shaped lobule at the base of the exterior border. Nails tawny.

"The measurements of a dry specimen are as follows: Width between extremities of wing, 0.180 m.; total length of body, 0.045; length of tail, 0.029; length of head, 0.016; length of ear, 0.012; length of forearm, 0.030; length of thumb, 0.005½; length of second or index finger, 0.029½; length of third finger, 0.055; of fourth finger, 0.046; of fifth finger, 0.040; length of tibia, 0.011; length of foot to the end of nails, 0.006¾; length of calcar, 0.013.

"This is a rare species. I have only observed it at Habana (Cerro) in a house where it lived in a crack above the window, and in the field near Cárdenas, where I killed it while flying about at dusk. A female contained two embryos in May."[1]

---

[1] Pelaje, por encima pálido-pardo (los pelos con la base negruzca), por debajo pálido bermejízo-pardo (la base de los pelos también negruzca). Cara y membranas voladoras, morenas. La nariz aparece algo dividida por las ventanas saltonas; entre la nariz y los ojos hay en cada lado un rollo con pelos tiesos. Orejas ovales, alargadas (por delante con 8 mil. de alto). La base anterior, redonda y extendida hácia fuera; la posterior, pelada en el ángulo de la boca y extendida en un semicírculo, que inclinado hácia dentro hasta la orejucla, forma una segunda ampliación redonda. Orejuela oblonga, adelgazándose apénas, algo encorvada en forma de hoz hácia delante, y provista en la base del borde exterior con un lóbulo dentiforme. Uñas pardas.

Las medidas, tomadas de un ejémplar disecado, son:

Anchura entre las puntas del ala, 0.180 mil.; longitud hasta el fin del cuerpo, 0.045; longitud del rabo, 0.029; longitud de la cabeza, 0.016; longitud de la oreja, 0.012; longitud del antebrazo, 0.030; longitud del pulgar, 0.005½; longitud del segundo dedo ó índice, 0.029½; longitud del tercero dedo, 0.055; longitud del quarto dedo, 0.046; longitud del quinto dedo, 0.040; longitud de la tibia, 0.011; longitud del pié hasta el fin de les uñas, 0.006¾; longitud del espolón, 0.013.

Es especie rara. La he observado solamente en la Habana (Cerro) en una casa donde vivia, en las rendijas sobre una ventana, y en el campo cerca de Cárdenas, donde la maté al oscurecer volando. Una ♀ tenia en mayo dos embriones.

Genus RHOGEËSSA H. Allen.

1866. *Rhogeëssa* H. Allen, Proc. Acad. Nat. Sci., Phila., p. 285 (genus).
1873. *Rhogëessa* Marschall, Nomenclator Zoologicus, Mamm., p. 11.
1878. *Rhogeëssa* Dobson, Catal. Chiroptera Brit. Mus., p. 245 (subgenus of '*Vesperugo*').
1893. *Rhogeëssa* H. Allen, Monogr. Bats N. Am., p. 132 (genus).

Type species.—*Rhogeëssa tumida* H. Allen.

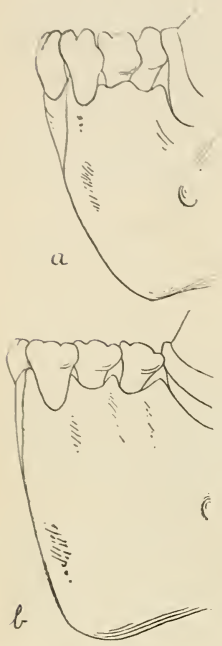

Fig. 37.—Left mandibular incisors of (*a*) *Rhogeëssa* and (*b*) *Nycticeius* (× 20).

Geographic distribution.—Tropical Mexico, Central America, and probably northern South America (known from Margarita Island, Venezuela).

Generic characters.—Dental formula:

$$i, \frac{1-1}{3-3}; \quad c, \frac{1-1}{1-1}; \quad pm, \frac{1-1}{2-2}; \quad m, \frac{3-3}{3-3} = 30;$$

lower incisors crowded, the outer cusp of first and second obsolete; third lower incisor greatly reduced in size, unicuspidate (figs. 37 *a* and 38 *a*); upper incisor very close to canine or in contact with it; skull small, light, and papery, narrow and deep; external form variable, but tragus always straight or bent backward, and tail included to tip in interfemoral membrane.

Remarks.—The genus *Rhogeëssa* has received varying treatment. It was originally described as a full genus whose relationships were supposed to be with *Nycticeius* and *Nyctinomus*. In 1878 Dobson referred it to '*Vesperugo*' as a subgenus. This view has been adopted by most subsequent writers except Mr. Oldfield Thomas and Dr. Harrison Allen, both of whom have recognized *Rhogeëssa* as a full genus related more closely to *Nycticeius* than to any of the genera usually included under the name '*Vesperugo*.' Mr. Thomas has pointed out characters in which *Rhogeëssa* resembles *Antrozous*. These characters, the reduced size of the outer lower incisor and slightly crenulate posterior border of tragus, seem to be instances of parallel development rather than indications of genetic relationship. The genus *Rhogeëssa* is closely related to *Nycticeius*, but the peculiarities of the lower incisors and the general form of the skull are enough to warrant its recognition.

Fig. 38.—Crowns of incisors of right mandible of (*a*) *Rhogeëssa* and (*b*) *Nycticeius* (× 20).

KEY TO SPECIES OF RHOGEËSSA.

Lateral mandibular incisor scarcely one-twentieth as large as central incisors ..... *alleni* (p. 128)
Lateral mandibular incisor one-half to two-thirds as large as central incisors.
  Ear laid forward, reaching about 6 mm. beyond tip of nose ..... *gracilis* (p. 126)
  Ear laid forward, reaching about to tip of nose.
    Fur grayish brown at base ..... *parvula* (p. 125)
    Fur yellowish throughout.
      Forearm about 30 mm ..... *tumida* (p. 123)
      Forearm about 25 mm ..... *minutilla* (p. 125)

RHOGEËSSA TUMIDA H. Allen.

1866. *Rhogeëssa tumida* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 286.
1877. *Vesperugo parvulus* Dobson, Catal. Chiroptera Brit. Mus., p. 245.

Type locality.—Mirador, Vera Cruz, Mexico.

Geographic distribution.—Central America and southern Mexico.

General characters.—Size small; length, 70 to 75; tail, 30 to 33; forearm, 27.4 to 30. Calcar strong, distinct, slightly longer than free border of uropatagium, terminating in a small but evident lobule conspicuously keeled on the posterior border. Free border of uropatagium naked. Ears moderate, laid forward they reach about to tip of nose. Wings from base of toes. Legs and feet short and strong, the feet when outstretched reaching to within 5 mm. of tip of tail. Fur yellowish, the hairs on the back with dusky tips.

Ears.—The ears (Pl. I, fig. 8) are moderately long, reaching, when laid forward, about to tip of nose; the substance of the conch thick and leathery. Anterior border strongly concave from base to a little past middle, then straight to narrowly rounded-off tip. Posterior border concave just below tip, then gently and evenly convex to base. No indication of basal notch.

Tragus directed slightly forward; the anterior edge nearly straight, but slightly concave at base, and curved a little backward at tip. Posterior edge faintly crenulate, concave below tip, then concave to slightly developed basal lobe. Greatest width of tragus at about middle of posterior border.

Membranes.—The membranes, especially the uropatagium, are remarkably thick and leathery for so small a bat. Throughout they are wholly naked except close to the body and along the veins on the interfemoral membrane. Wings from base of toes. Uropatagium (Pl. I, fig. 13) attached at tip of terminal caudal vertebra.

Feet.—The feet and legs (Pl. I, fig. 13) are short and strongly built, in this respect resembling *N. humeralis*. The foot is scarcely one-half as long as the tibia, and the toes are slightly longer than the sole. The toes are not united by membrane at base. Calcar distinct and strong, slightly longer than free border of uropatagium. Lobule at

tip of calcar small but distinct. Keel well developed and supported by one or two cartilaginous outgrowths.

Fur and color.—There is nothing peculiar in the distribution of the fur. It extends in a very narrow line on the wings along the side of the body both dorsally and ventrally, and on the uropatagium covers the basal fourth dorsally but scarcely reaches the membrane on the ventral side.

In color the fur is dull yellowish brown throughout, scarcely paler ventrally, the hairs dusky at tip. Ears and membranes dark brown.

Skull.—In general appearance the skull of *Rhogeëssa tumida* (fig. 39) stands between that of *Nycticeius humeralis* and *Pipistrellus subflavus*. The skull of an adult female from Santo Domingo, Oaxaca (No. 73267, United States National Museum, Biological Survey collection), measures: Greatest length, 13; zygomatic breadth, 8.4; breadth of rostrum at anterior edge of first molar, 5; mandible, 9;[1] upper tooth row, 5.6; lower tooth row, 6. That of an adult female from Patuca, Honduras (No. 21017, United States National Museum), measures: Greatest length, 12.4; zygomatic breadth, 8; breadth of rostrum at anterior edge of first molar, 4; mandible, 9.4; upper tooth row, 5; lower tooth row, 6. The rostrum is relatively narrower than in *Nycticeius* and the occiput is more elevated. The muzzle is distinctly concave in front of orbits instead of flat or almost convex as in *Nycticeius*.

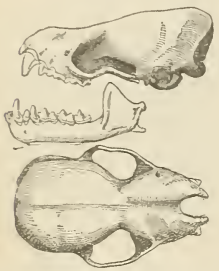

FIG. 39.—Skull of *Rhogeëssa tumida* (×2).

Teeth.—Upper incisor usually in contact with canine, though occasionally separated by a narrow space (fig. 40*a*). Maxillary teeth essentially as in *Nycticeius*, but premolar relatively larger and posterior molar narrower in proportion to its length.

Lower incisors greatly crowded, the outer cusp of $\overline{i}$ 1 and $\overline{i}$ 2 much smaller than middle and inner cusp. Outer lower incisor uni-uspidate, about one-half the size of $\overline{i}$ 1 or $\overline{i}$ 2. Other mandibular teeth essentially as in *Nycticeius*, but premolars more crowded.

Measurements.—See table, page 129.

Specimens examined.—Total number, 10, from the following localities:

Colima: Colima, 3.
Costa Rica: ———, 1.
Guatemala: Huehuetan, 1.
Guerrero: Amula, 1 (Merriam coll.).
Honduras: Patuca, 2.
Oaxaca: Santo Domingo, 1.
Vera Cruz: Mirador, 1.

General remarks.—*Rhogeëssa tumida* needs comparison with *R. parvula* and *R. minutilla* only. From the former it is distinguished by its clear yellowish fur without darker base, and from the latter by its considerably larger size.

[1] As the mandible is imperfect, this measurement is only approximately correct.

Dobson and most subsequent authors have wrongly applied the specific name *parvula* to this species. So far as known *R. parvula* is restricted to the Tres Marias Islands.

[The following species is not North American, but is introduced here to complete the account of the genus *Rhogeëssa*.]

RHOGEËSSA MINUTILLA Miller.

1896. *Vesperugo parvulus* Robinson, Proc. U. S. National Museum, XVIII, p. 651 (not *Rhogeëssa parvula* H. Allen).

1897. *Rhogeëssa minutilla* Miller, Proc. Biol. Soc. Washington, XI, p. 139, May 13, 1897.

Type locality.—Margarita Island, Venezuela. (Type in U. S. National Museum, No. 63216.)

Geographic distribution.—This species is probably confined to Margarita Island.

General characters.—Similar to *Rhogeëssa tumida*, but considerably smaller (forearm, only 25 mm.).

Ears.—The ears of the type (when relaxed by soaking in water) appear to be smaller and narrower than in *R. tumida*, but otherwise not peculiar.

Membranes, feet, and distribution of fur.—As in *R. tumida*.

Color.—Fur everywhere light yellowish brown to base, the hairs on the back tipped with chestnut. The color appears to differ slightly from that of *R. tumida*, but I have too few skins to make an adequate comparison.

Skull.—The skull of the type and only known specimen is so much injured that its characters can not be determined with certainty, but it appears to be smaller and relatively narrower than that of *R. tumida*. Greatest length, 11.8; length of mandible, 9; upper tooth row, 5; lower tooth row, 5.6.

Teeth.—The teeth are essentially as in *R. tumida*.

Measurements.—The measurements of the type specimen are given in the table on page 129.

Specimens examined.—One, the type.

General remarks.—*Rhogeëssa minutilla* is a small insular form most closely related to *R. tumida*, but apparently perfectly distinct. So far as I know the genus *Rhogeëssa* has not yet been recorded from the mainland of South America, where, however, it doubtless occurs.

RHOGEËSSA PARVULA H. Allen.

1866. *Rhogeëssa parvula* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 285

Tpye locality.—Tres Marias Islands, Mexico.

Geographic distribution.—Tres Marias Islands.

Characters.—As I have seen no specimens of this species, I quote the original description entire. It is as follows:

"Ear sub-acute at tip; lips whiskered; eyes very small, each furnished with a wart above; similar growth seen beneath chin. Fur above silky, not thick, of a light greyish-brown at basal third, fawn-

chestnut-brown at apical two-thirds; that of head same color, running on to the ears one-half their height. Beneath, basal third inclined to greyish; apical two-thirds grayish fawn. Membranes almost black, naked, excepting basal fourth of interfemoral membrane behind, which is furnished with a small, short patch of glistening fur.

"*Measurements*—7841.

"Height of auricle 6″ [12.7 mm.]; height of tragus 3″ [6.4]; length of head 7″ [14.8]; length of body 10″ [21.1]; length of tail 1′ 2″ [30.5]; length of forearm 1′ 1″ [27.4]; length of longest finger 1′ 11″ [48.5]; length of thumb 2″ [4.2]; length of tibia 5″ [10.6]; length of foot 2½″ [5.3]; expanse 6′ 7″ [16.7].

"Two individuals, ♂ and ♀; Nos. 7841, 7842, Museum of Smithsonian Institution. Alcohol.

"Tres Marias, Mexico. Col. Grayson."

RHOGEËSSA GRACILIS sp. nov.

Type from Piaxtla, Puebla. Adult ♂ (in alcohol). No. 70694, U. S. Nat. Museum, Biological Survey collection. Collected Nov. 24, 1894, by E. W. Nelson and E. A. Goldman. Collector's number, 7099.

Geographic distribution.—Southern Mexico (Puebla and 'Isthmus of Tehuantepec').

General characters.—Size, medium; length, 79 to 82; tail, 38.6 to 41; forearm, 32 to 33. Calcar slender but distinct, a little shorter than free border of uropatagium, terminating in a small lobule, distinctly keeled on the posterior border. Free border of uropatagium naked. Ears long; when laid forward extending about 6 mm. beyond tip of nose. Wings from base of toes. Feet and legs long and slender, the outstretched feet reaching to within about 10 mm. of tip of tail.

Ears.—The ears (Pl. I, fig. 7) are long, and at the same time broad; laid forward they reach about 6 mm. beyond tip of nose; the substance of the conch thin and translucent. Anterior border strongly convex from base to a little below middle, then straight or very slightly convex to the rather broadly rounded off tip. Posterior border concave below tip to about middle, where it bends abruptly outward, then gradually convex to base. A very faintly indicated basal notch and basal lobe. About 5 mm. above the crown and an equal distance from the tip of the ear conch in the male is developed a conspicuous, flattened-pyriform, glandular thickening with the large end toward the anterior margin of the ear and the main axis nearly perpendicular to that of the auricle. The thickened mass is 5 mm. in length, 4 mm. wide at the broad end, 2 mm. at the narrow end, and 1 mm. thick. It is most conspicuous on the dorsal side of the ear, where, although not different in color from the rest of the ear, it is noticeably raised above the surface, and the boundaries are sharply marked. On the inner side of the ears the thickenings are less definite in outline, but are noticeably paler than the surrounding integument. When these structures are examined with a lens it is seen that they are thickly covered on the

outer side with pores lying mostly at the bases of the fine hairs with which the surface is beset. The thickened masses are of exactly the same size and shape in the two ears and are placed symmetrically with respect to the outlines of the conchs.

Tragus slender and taper pointed, slightly bent backward at the tip, and broadest opposite anterior base. The anterior border is slightly concave at base, then evenly convex to tip. The posterior border is strongly concave from tip to a point slightly above the middle, where the tragus attains a width nearly equal to that at level of anterior base. From this point to the basal lobe the posterior border is nearly straight and about parallel with the lower part of the anterior border. Basal lobe small but prominent. Posterior border of tragus crenulate, especially near the middle, where there are five or six minute sharply projecting points, from the bases of which thickened processes may be traced a short distance into the substance of the tragus when the latter is held to the light.

Membranes.—The membranes are thin and semitransparent, the uropatagium not different in texture from the wings. Throughout they are entirely naked, except for a narrow line of hair on the wings extending along sides of body about to a line drawn halfway between knee and elbow. On the uropatagium there is also a narrow hairy area close to body and a sprinkling of fine hairs along the veins. Wings from base of toes. Uropatagium (Pl. I, fig. 12) attached at tip of terminal caudal vertebra.

Feet.—The feet are small and weak, distinctly less than half as long as the slender tibiæ (Pl. I, fig. 12). Toes longer than sole, cleft to base. Calcar slender but very distinct, about as long as free border of uropatagium and terminating in a small and ill-defined lobule. Keel remarkably well developed, extending from near tip of calcar almost to base and supported by four cartilaginous processes.

Fur and color.—The fur is long, that on middle of back averaging about 9 mm. It extends farther on the membranes than in *R. parvula*, but otherwise shows no peculiarities. In color it is everywhere light sepia at base, then dull yellowish brown, that on the back tipped with chestnut. As this description is from a specimen that has been immersed in alcohol for nearly two years and a half, it can not be more than approximately accurate.

Skull.—The skull of *Rhogeëssa gracilis* is longer and more slender than that of *R. tumida*, and the forehead appears to be more abruptly raised above the face line. The zygomata are less widely flaring in front. Apparently the occiput is considerably narrower than in *R. tumida*. From the material at hand it is, however, impossible to determine the cranial characters with accuracy, since of the skull of the female topotype there remains only the mandible and rostral portion, while the skull of the type is so much injured that it would not hold together if removed from the skin and cleaned.

Teeth.—The teeth of *Rhogeëssa gracilis* (fig. 40) differ from those of *R. tumida* in numerous details. The crowns of the upper molars are much narrower on the lingual side and the posterior upper molar is considerably broader. The front lower premolar is slightly larger than in *R. tumida*, but otherwise the mandibular teeth show no distinct differences.

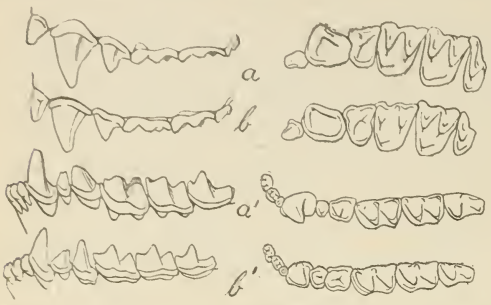

FIG. 40.—Teeth of (*a*) *Rhogeëssa tumida* and (*b*) *R. gracilis* (×5).

Measurements.—See table, page 129.

Specimens examined.—Total number, 3, from the following localities:

Isthmus of Tehuantepec, 1.
Puebla: Piaxtla, 2.

General remarks.—*Rhogeëssa gracilis* is so readily distinguished from the other species of the genus by its slender form and very large ears that no detailed comparisons are necessary.

This is the only species of North American *Vespertilionidæ* in which I have found any sexual differences in cutaneous structures.

RHOGEËSSA ALLENI Thomas.

1892. *Rhogeëssa alleni* Thomas, Ann. & Mag. Nat. Hist., 6th ser., X, p. 477, December, 1892.

Type locality.—Santa Rosalia, near Autlan, Jalisco, Mexico. Type in British Museum.

Geographic distribution.—*Rhogeëssa alleni* is known from the type locality only.

Characters.—As I have not seen the type and only known specimen of this bat, I copy Mr. Thomas's original description:

"Decidedly larger than *Rh. parvula;* muzzle obliquely truncate as in that species. Ears large, laid forward they reach about 1 or 2 millim. beyond the nostrils; their inner margin very convex forwards below, straight or even slightly concave above; tip narrowly rounded off; outer margin concave below the tip, then straight, becoming slightly convex below, outer basal lobe but little marked. Tragus long, its broadest point opposite to base of its inner edge; inner edge straight or slightly concave, tip rounded, outer margin slightly convex, the edge indistinctly crenulate, somewhat as in *Antrozous pallidus;* a marked lobule at the base of the outer margin, above and below which there is a concavity. Thumb very short and thick, no longer than in *Rh. parvula.* Posterior edges of wing-membrane bordered with white, bifid tip to fourth finger unusually distinct: wings from the base of the fifth toe; post-calcareal lobe small and narrow; tip of calcar projecting slightly from the back of the membrane; tail included in membrane to the extreme tip."

"*Teeth.*—Upper incisors one on each side, long, slender, unicuspid; upper premolars large, quite close to the canines; no trace of a minute anterior premolar. Lower incisors six, the four median ones broad, tricuspid; the outer ones unicuspid, exceedingly minute, practically invisible from in front, and scarcely one-twentieth of the size in cross section of the median incisors; far smaller therefore both absolutely and relatively than in *Rh. parvula*.

"Dimensions of the type (an adult female in spirit):—

"Head and body 47 millim; tail 41; ear above head 12.2, from notch 16; tragus, inner margin 7; forearm 35; thumb 5; metacarpal of third finger 33.5; lower leg 15.5; hind foot 7.1; calcar 15.

"Skull of a second specimen: Occiput to gnathion 14.7; greatest breadth 9.5; distance from front of canine to back of m. 3 5.4."

Measurements of specimens of Rhogeëssa.

Name.	Locality.	Number.	Sex and age.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
tumida	Vera Cruz: Mirador	8195	♂ ad.	65.5	25.4	10.4	5.1	29.5	4.8	57.2	.....	.....	7.3
	Colima: Colima	52102	♀ ad.	75	34	12	5	29.8	4	52	12.8	9.6	7
	Colima	52065	♂ ad.	70	33	11.4	5.4	30	4	52	12.4	9.4	7.4
	Colima	52066	♂ ad.	70	30	11	5.4	28	4	51	12.6	9	7
	Oaxaca: Santo Domingo.	73269	♀ ad.	.....	.....	12	7	33	4.4	63	13.6	9.6	7.2
	Guatemala: Huehuetan.	78600	♂ ad.	75	33	11.4	6	30	4.6	56	14	9	7
	Honduras: Patuca	21016	♀ ad.	73	30	12	6	30	4	55	12.6	9	7
	Patuca	21017	♀ ad.	75	31	12.4	5.6	30	4	57	13	9	7
parvula	Tres Marias Islands	7841	[1]♂ ad.	65.5	29.5	10.4	5.3	27.4	4.1	48.5	.....	.....	6.4
minutilla	Venezuela: Margarita Island.	63216	[2]♂ ad.	.....	25	11	5	25	3.6	51	11.8	8	6.4
gracilis	Puebla: Piaxtla	70691	♀ ad.	79	38.6	14	6	32	4	60	17	11	10
	Piaxtla	70694	[2]♂ ad.	82	41	14.6	5	33	4.4	61	16.6	11.8	10
	Isthmus of Tehuantepec.	11240	♀ ad.	77	37	13	5	30	4	58	16	11	9
alleni	Jalisco: Autlan	.....	[3]♀ ad.	.....	41	.....	7.1	35	5	.....	.....	.....	7

[1] Type, measurements from H. Allen. [2] Type. [3] Type, measurements from Thomas.

INDEX TO GENERIC AND SPECIFIC NAMES.

[Names in italics are here recognized as valid.]

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yumanensis (Vespertilio), 38, 39, 66, 69.

PLATE I.

[One and one-half times natural size.]

FIG. 1. *Myotis relifer* (J. A. Allen). Patzcuaro, Michoacan, Mexico.
(No. 52179, U. S. Nat. Mus.)

2. *Myotis californicus* (Audubon & Bachman). Nicasio, Cal.
(No. 1512, Merriam collection.)

3. *Myotis yumanensis* (H. Allen). Tulare, Cal.
(No. 30709, U. S. Nat. Mus.)

4. *Nycticeius humeralis* Rafinesque. Brownsville, Tex.
(No. 52613, U. S. Nat. Mus.)

5. *Myotis thysanodes* Miller (topotype). Old Fort Tejon, Cal.
(29824, U. S. Nat. Mus.)

6. *Myotis evotis* (H. Allen). Bull Lake, Wyoming.
(No. 55846, U. S. Nat. Mus.)

7. *Rhogeëssa gracilis* Miller (type). Piaxtla, Puebla, Mexico.
(No. 70694, U. S. Nat. Mus.)

8. *Rhogeëssa tumida* H. Allen. Colima, Mexico.
(No. 52065, U. S. Nat. Mus.)

9. *Corynorhinus macrotis townsendii* (Cooper). Gold Beach, Oregon.
(No. 88542, U. S. Nat. Mus.)

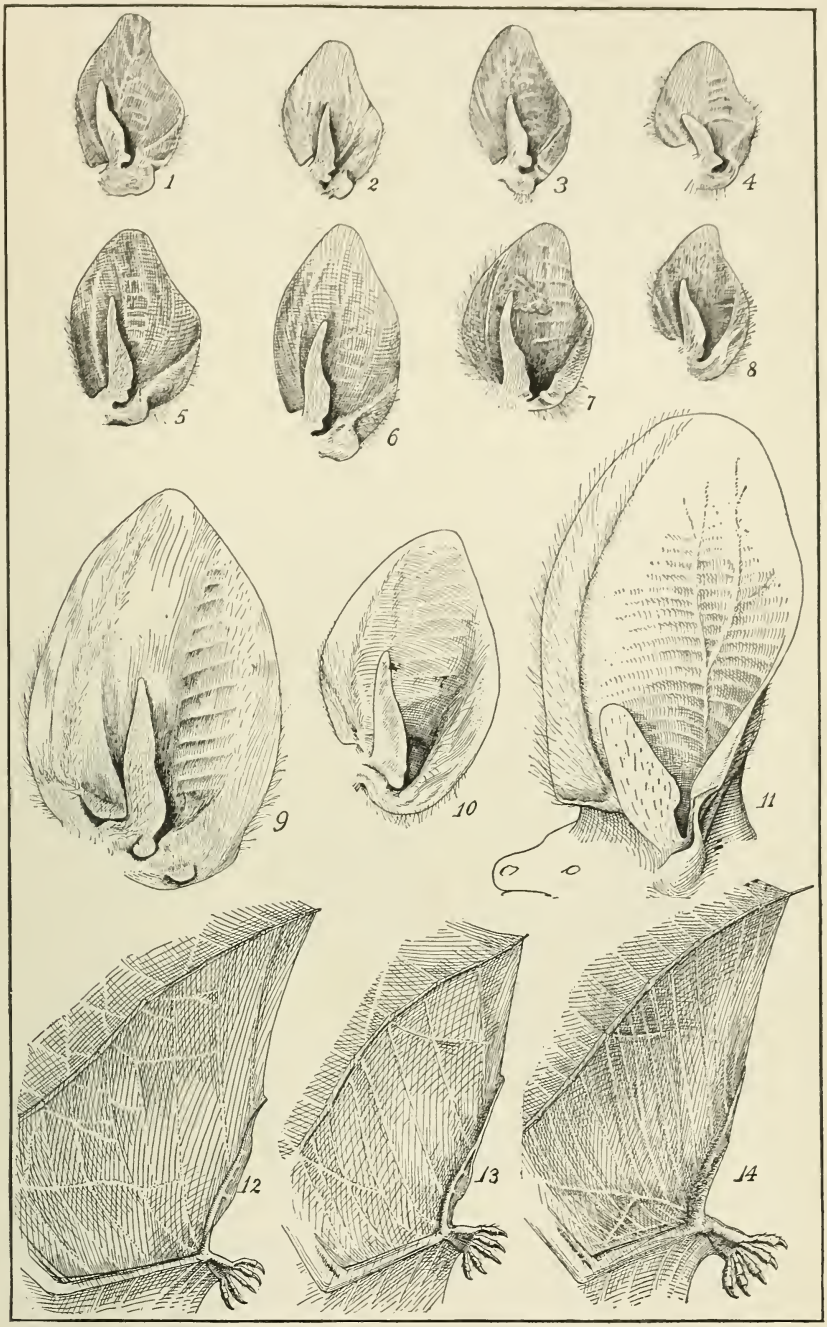
10. *Antrozous pallidus* (Le Conte). Sycamore Creek, Texas.
(No. 24155, U. S. Nat. Mus.)

11. *Euderma maculatum* (J. A. Allen) (type). Ventura County, Cal.
(No. $\frac{3923}{2951}$, Am. Mus. Nat. Hist., N. Y.)

12. *Rhogeëssa gracilis* Miller (type). Piaxtla, Puebla, Mexico.
(No. 70694, U. S. Nat. Mus.)

13. *Rhogeëssa tumida* H. Allen. Colima, Mexico.
(No. 52065, U. S. Nat. Mus.)

14. *Nycticeius humeralis* Rafinesque. Brownsville, Tex.
(No. 52613, U. S. Nat. Mus.)



1. *Myotis velifer.*
2. *Myotis californicus.*
3. *Myotis yumanensis.*
4. *Nycticeius humeralis.*
5. *Myotis thysanodes.*
6. *Myotis evotis.*
7. *Rhogeëssa gracilis.*
8. *Rhogeëssa tumida*
9. *Corynorhinus macrotis townsendi.*
10. *Antrozous pallidus.*
11. *Euderma maculatum.*
12. *Rhogeëssa gracilis.*
13. *Rhogeëssa tumida.*
14. *Nycticeius humeralis.*

PLATE II.

[One and one-half times natural size.]

FIG. 1. *Myotis californicus* (Audubon & Bachman). Nicasio, Cal.
(No. 1512, Merriam collection.)

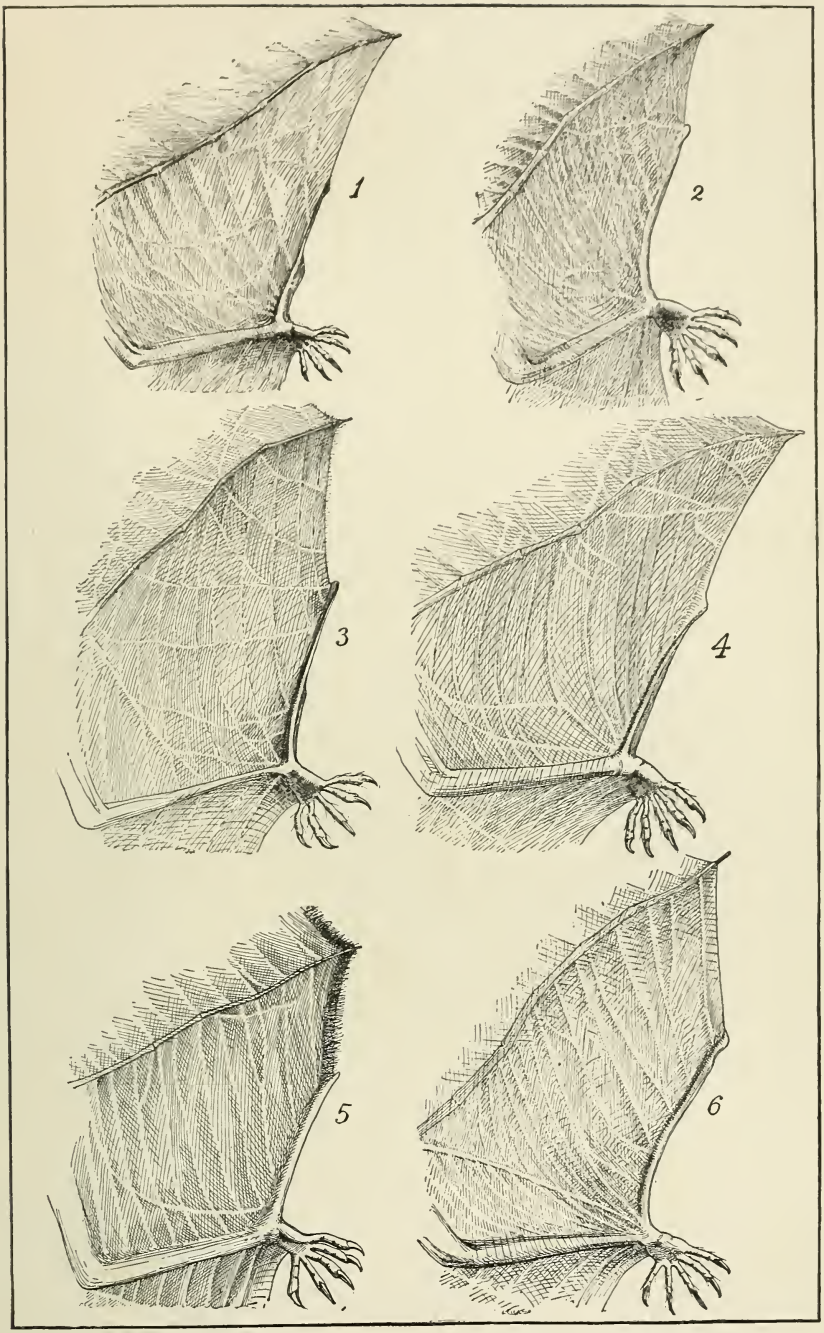
2. *Myotis yumanensis* (H. Allen). Tulare, Cal.
(U. S. Nat. Mus.)

3. *Myotis evotis* (H. Allen). Bull Lake, Wyoming.
(No. 55846, U. S. Nat. Mus.)

4. *Myotis evotis* (H. Allen). Perote, Vera Cruz, Mexico.
(No. 88541, U. S. Nat. Mus.)

5. *Myotis thysanodes* Miller (type). Old Fort Tejon, California.
(No. 29827, U. S. Nat. Mus.)

6. *Myotis velifer* (J. A. Allen). Patzcuaro, Michoacan, Mexico.
(No. 52282, U. S. Nat. Mus.)



1. *Myotis californicus.*
2. *Myotis yumanensis.*
3. *Myotis evotis* (Bull Lake, Wyo.).
4. *Myotis evotis* (Perote, Mexico).
5. *Myotis thysanodes.*
6. *Myotis velifer.*

PLATE III.

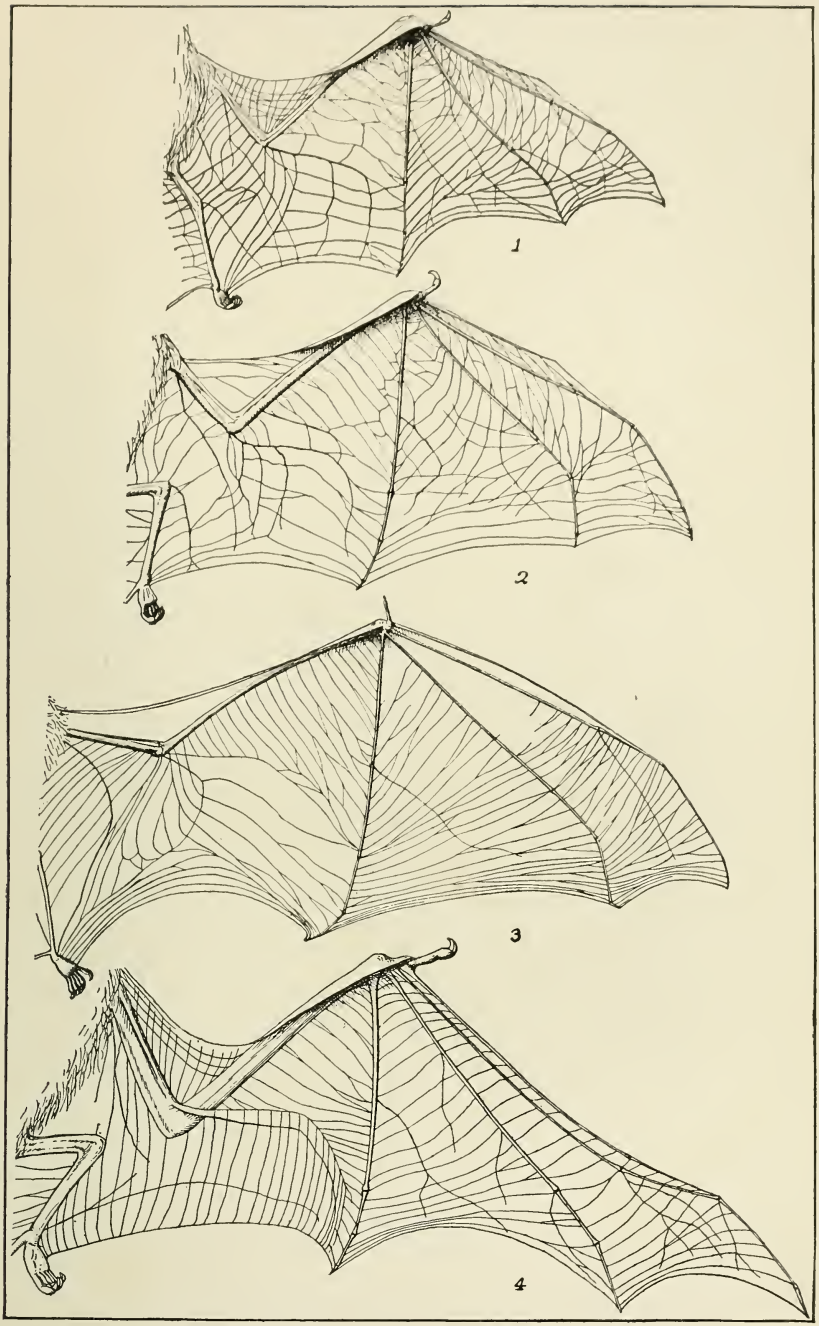
[Two-thirds natural size.]

FIG. 1. *Plecotus auritus* (Linn.). Höllsteig, Baden, Germany.
(No. 4495, Miller collection.)

2. *Corynorhinus macrotis pallescens* Miller. Owens Lake, Cal.
(No. 28954, U. S. Nat. Mus.)

3. *Euderma maculatum* (J. A. Allen) (type). Ventura County, Cal.
(No. $\frac{3930}{2991}$, Am. Mus. Nat. Hist., N. Y.)

4. *Lasiurus cinereus* (Beauvois). Vegas Valley, Nevada.
(No. 27976, U. S. Nat. Mus.)



1. *Plecotus auritus.*
2. *Corynorhinus macrotis pallescens.*
3. *Euderma maculatum.*
4. *Lasiurus cinereus.*

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